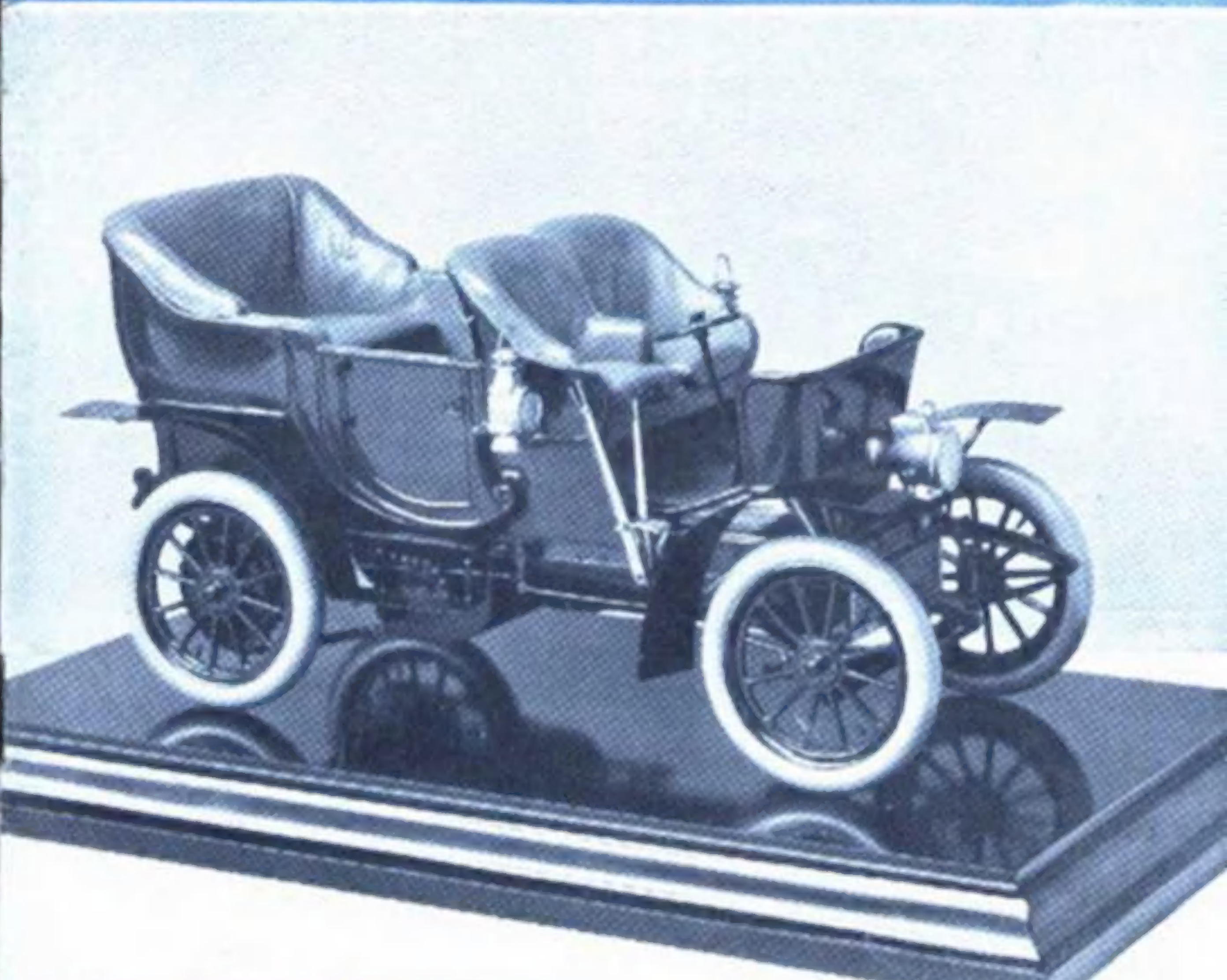
THE MODEL ENGINEER



IN THIS ISSUE

- MAKING A DRAUGHTING MACHINE
- USING MODELS FOR HULL DESIGN
- THE BRITISH CRAMPTON LOCOMOTIVES
- QUERIES AND REPLIES
- A BELT AND DISC SANDER FOR LATHE
- ARCHITECTURAL MODEL
- READERS' LETTERS

MARCH 12th 1953
Vol. 108 No. 2700

9D

THE MODEL ENGINEER

EVERY THURSDAY
Volume 108 - No. 2703
MARCH 12th, - 1953

ESTABLISHED 1898

PERCIVAL MARSHALL & CO. LTD. 19-20 NOEL STREET · LONDON · W·1

CONTENTS

Our Cover Picture

Although the history of the motor car extends back but little more than half a century, its influence on the progress of engineering design, metallurgy and machine tools has been very far reaching. While the modern forms of cars, especially those of sporting types, enjoy a certain popularity as subjects for model construction, not much has been done in the way of modelling historic examples, though these are certainly no less interesting from the aspect either of mechanical details or bodywork. Early British and European cars offer good scope for the talent of the model maker, and we illustrate here an interesting model of a 15-20 h.p. Lea-Francis four-seater touring car, period 1902 to 1907. This particular car had a three-cylinder engine, 4 in. bore by 6 in. stroke, with cone clutch, three-speed gearbox, bevel differential, and final drive by chains to both rear wheels. In several respects the design was well ahead of its time, the engine having a drilled crankshaft for forced lubrication to the bronze big-end bearings and a valve gear of unusual design, operated from an overhead camshaft. The model shown is to 1/10 th. scale and was built for the Motor Industry's Jubilee Exhibition in 1946.

SMOKE RINGS

The 1953 "Model Engineer" Exhibition

WE ARE able to announce that the dates of this year's MODEL ENGINEER Exhibition will be from Wednesday, August 19th until Saturday, August 29th. The venue will be, as usual, the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Readers should make a note of the dates. Further announcements will be made from time to time in the future, as required.

Free-lancing

AS A result of some recent "Smoke Rings" in which we have ventured to make some remarks touching upon the subject of free-lance models, we have received some letters which clearly show that the writers and ourselves are at cross-purposes on the meaning of the term "free-lance." So we will take this opportunity of endeavouring to help those readers who are in doubt over this controversial matter.

A free-lance model is, obviously, one that is not a copy of any existing prototype ; it may, or may not embody new ideas, from a technical viewpoint. At its best, however, it should have been built from an original design developed according to the ideas of its designer for the specific purpose of either improving its performance or of meeting some special and predetermined conditions of working. Any novel mechanical contrivance built from an original design is "free-lance" ; but the point is that, in order to work out an initial design, the designer cannot hope to achieve success unless he, or she, has a thorough knowledge of the fundamental principles governing the design. In other words, the designer must be something of a genius in order to make a success of the design ; at the very least, he, or she, must be fully acquainted with all the basic information that will enable him, or her, to go one better than established prototype practice in whatever field he, or she, is designing. It is in this manner alone that progress is made in engineering development.

It follows, therefore, that a free-lance model is much more difficult to produce than is one which follows some existing prototype in which, obviously, all the designing has been done ; further, to describe as "free-lance" a model which is merely a grotesque caricature of prototype practice cannot be too strongly condemned. At the same time, there is nothing to be said against a model that is built in accordance with prototype practice but embodying its builder's ideas of neatness, good proportion and convenient arrangement ; if these features can be combined with good, or even improved performance, so much the better.

An Exhibition in Birmingham

THE BIRMINGHAM Society of Model Engineers is now actively carrying out plans for its "Coronation Year" exhibition, for which every effort is being exerted to make it a really outstanding show. The Right Worshipful the Lord Mayor of Birmingham will attend at Bingley Hall on May 4th to open the exhibition, at 3 p.m. ; the show will remain open until the 9th.

Provision is being made to install a typical model engineer's workshop in working order and, it is hoped, housed in a specially sectioned shed erected for the purpose. There is also to be a special stand for displaying models that will be run under compressed air at frequent intervals. A neighbouring society has kindly arranged to loan a portable track on which to run 3½-in. and 5-in. gauge locomotives.

Local suppliers of tools and materials will be strongly represented and there will be frequent and various demonstrations of power tools. About the beginning of April, posters advertising the exhibition will be obtainable from Mr. C. D. Picknell, 254, Reddings Lane, Birmingham 28.

A belt and disc sander for the lathe

By S. E. Capps

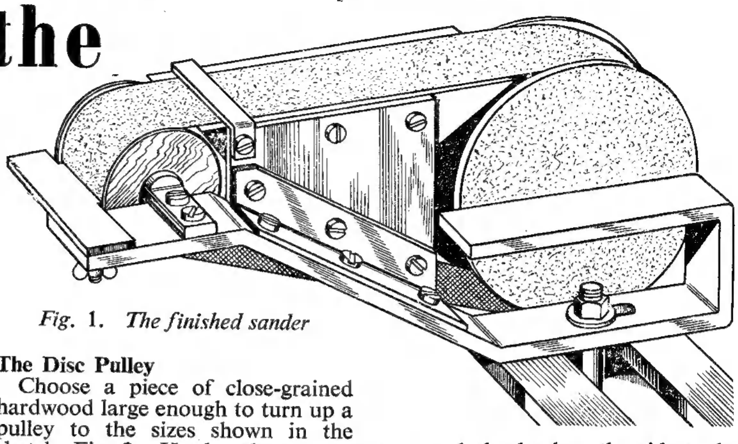


Fig. 1. The finished sander

MANY homeworkers, once they have used a sanding disc or a belt sander, realise the vast amount of tedious handwork such equipment can save. This usually leads to the purchase of one, if not both machines. There are many, however, who have not the room for extra machines, and some who cannot spare the cash. The description of the combined disc and belt sander shown in the sketches made by the writer should dispose of both of these objections, inasmuch as, if the homeworker has a lathe, there is no need to be without a disc or a belt sander, as the attachment is made up mostly from scraps of metal and wood. All the general sizes are given for fitting to a small lathe of $3\frac{1}{2}$-in. centres. As will be seen, the design is simple and construction is straightforward, involving part fitting and part turning, both of which should be well within the skill of the homeworker used to metal working. Each part was made separately in the following order, and the finished attachment is shown in Fig. 1.

The Disc Pulley

Choose a piece of close-grained hardwood large enough to turn up a pulley to the sizes shown in the sketch, Fig. 2. Hard mahogany or oak is most suitable, although there are other hardwoods available now almost as good. It can also be made up from a number of plywood discs glued and screwed together. Cut the block round to the full diameter of the lathe faceplate, and mount it thereon, secured with screws from the back. Face off the side true, and bore out, then screwcut to fit the mandrel nose thread of the lathe. Cutting this thread may be somewhat difficult to the worker not used to cutting coarse threads in wood, but no trouble will be encountered if a correctly shaped and keen tool is used, and light cuts taken until the full shape of the thread is formed. Make it a tight fit on the nose thread. During cutting, it can be continually tried by unscrewing the faceplate and trying the job on the nose as the thread takes shape. When a good fit is obtained, remove the block from the faceplate, and screw it up tight on the mandrel nose. In this position the top and other side can be turned up to the sizes shown in the sketch. This completes the disc, which only has to have a piece of emery-cloth glued to the side to be ready for use. The builder need proceed no further unless the belt sander is required as well.

Belt Sander Frame

Fig. 3 gives details of shape and sizes of the frame. Bright drawn mild-steel is used, as this can be forged accurately without trouble. In bending, a plan is drawn of the shape required, on a piece of slate, and as each bend is formed it is tried against the drawing. Heat the metal to bright red only, using several heats if necessary for each bend. Do not heat above this colour or burning of the surface of the metal may result, which will produce bad scaling, and this will make a lot of unnecessary cleaning up of the frame in the finished state. The writer used a steel block and a good vice, and used the hammer only for final truing the corners. Take particular care with the height of the frame top from the lathe bed, and the upward pitch of the frame to the small pulley position. The latter must be correct so as to bring the top of the small pulley level with the top of the disc

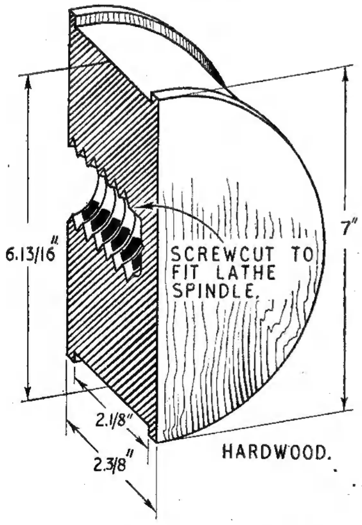


Fig. 2. Disc pulley

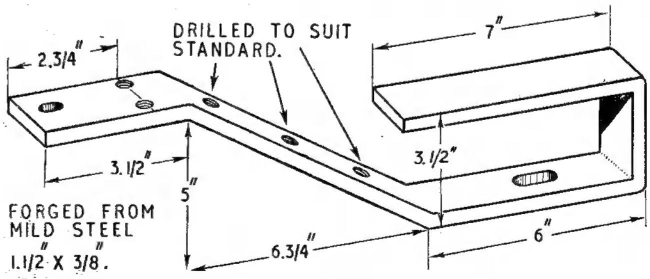


Fig. 3. Belt sander frame

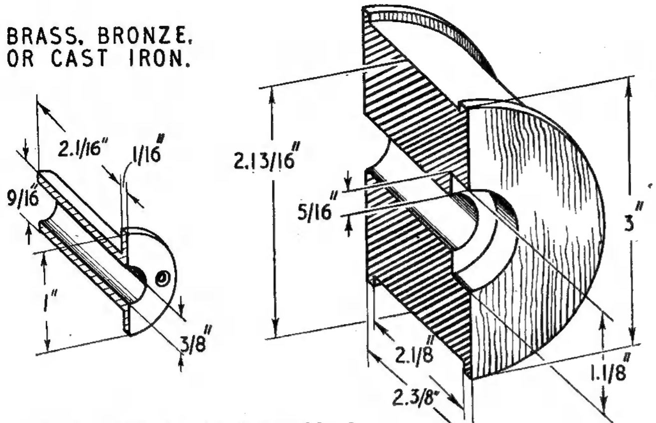


Fig. 4. Details of pulley and bush

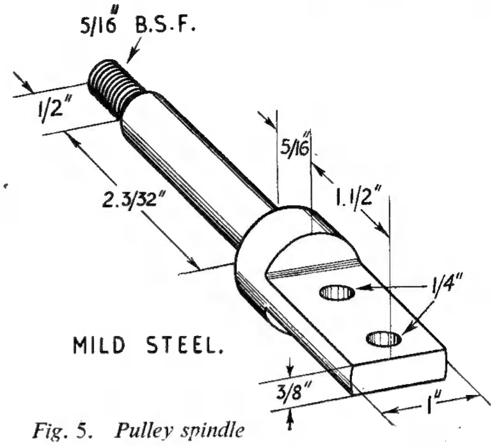
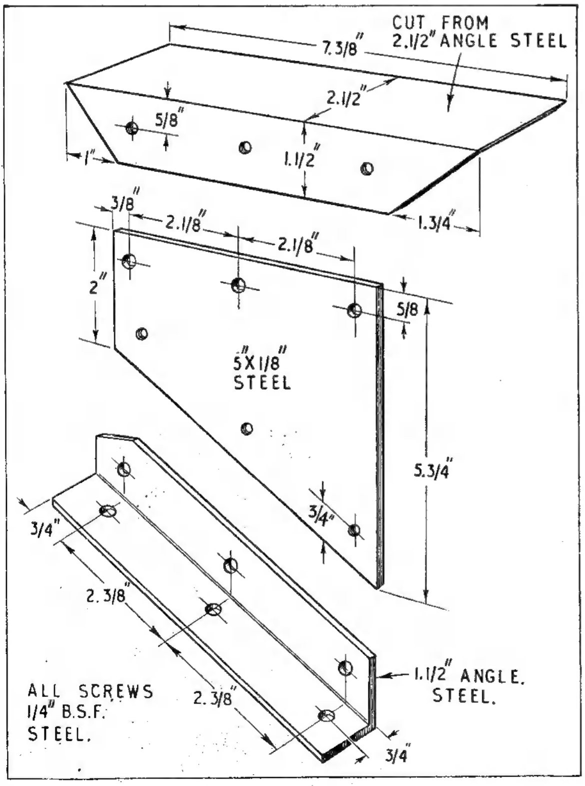


Fig. 5. Pulley spindle

pulley. The part of the frame used as a rest for the disc should be flat, square and smooth, with its top just level with the centre of the disc. The bottom, where it contacts the lathe bed, should also be flat and smooth, in order that it can be bolted down to the bed truly, and without risk of damage to the bed. The slotted hole for fixing to the lathe bed can be drilled, and those for fixing the small pulley spindle to the frame can also be drilled and tapped. The end slotted hole for the rest, and those to hold the table column, are left till later. Remove all burrs and sharp edges after each operation, to avoid cut hands.

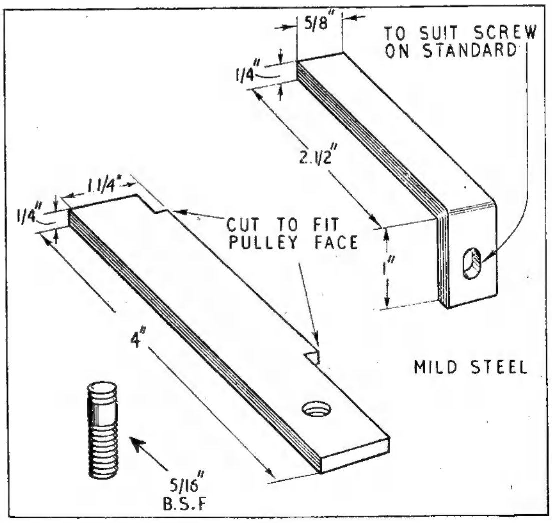
Small Pulley and Spindle

Hardwood is again used for making the small pulley. The block is held in the lathe chuck faced off and drilled, then bored and counterbored to the sizes shown in Fig. 4 in the one setting. It is then removed from the chuck, mounted on a mandrel between centres, and the top and other side finished turned. Care should be taken not to damage the side flanges while turning. Use a sharp tool and smooth with fine sandpaper. The bush is turned in the chuck from a piece of bronze hard brass, or cast-iron, and made a tight fit in the pulley bore. The outside diameter bore and end flange are finished and the bush parted off in the one setting. This ensures a truly concentric bush. Two small countersunk holes are drilled in the flange to secure it to the pulley at the bottom of the counterbore. Note that the bush, when fitted to the pulley, projects slightly at the smaller end. Fig. 5 gives details of the spindle to carry this pulley. Bright mild-steel is again used to make this spindle, which is turned up in the chuck, the bearing part and the end thread



(Left) Fig. 6. Details of belt table and column

(Below) Fig. 7. Details of fence and rest



being turned in the one setting. Use keen tools and plenty of cutting oil, and make the bearing part a good running fit in the bush. If an excess length of metal has been used, part off the spindle to the correct length overall and cut the two side flats on the end in the vice. (Unless a milling machine is available.) This concludes the turning. Fit the spindle to the frame, taking care to see that it is true and square both with the frame and with the run of the lathe bed. See that the shoulder of the under-flat butts hard up against the side of the frame, and fix it in this position. Should it not be quite square, a little easing of one of the screw holes with a round file will correct matters.

Belt Table and Column

The construction of the table and its supporting column is carried out with sections of bright mild-steel, and is straightforward cutting and fitting, and drilling and tapping. The shape and sizes of the three parts are shown in Fig. 6, with the arrangement of the parts as a vertical column. Mark out and cut all pieces carefully to shape and sizes shown, and remove any sharp edges before marking and drilling. In tapping the holes, use the right tapping size drill, and use cutting oil, both with drilling and when cutting the threads. Mild-steel can be very hard on drills and taps if such work is carried out without cutting oil being used. When the work is ready, assemble the parts together and tighten up the screws hard. Bolt the frame to the lathe bed as close to the disc face as possible. Now place the column on the incline of the frame and lay a straight-edge across the tops of both the disc and the small pulley. The table should reach to within 1/32 in. of the straight-edge and lay parallel along its surface. It may be that the table is not quite parallel, or it slopes to one side a bit, slight readjustment of some of the screw holes with a round file will in all probability correct matters. If not, one or more of the parts are out of true slightly, or wrong in size. A check over will soon elucidate the trouble, which, once found, can soon be rectified. When the column is in the right position, carefully mark through the base holes with a scriber. Drill and tap the holes and fix the column in position. Check over again for level, and if right, tighten the screws up hard. Use good round or hexagon-headed machine screws, and see that they are straight. The table fence and the small pulley rest can now be made and fitted. The fence passing over the table has its fixing hole slightly slotted for adjustment, and adjustment is provided for the rest by slotting its fixing hole in the frame. Details of fence and rest are shown in Fig. 7.

Assembly

Fig. 8 gives a view of the complete set of parts ready for assembling. Very little need be said about this, as, if all parts are to correct size, the attachment will go together without trouble. Well oil the small pulley spindle before locking this in place with the nut and washer. Line the attachment up with the disc on the mandrel, and tighten up on the lathe bed, with the two

(*Continued on page* 322)

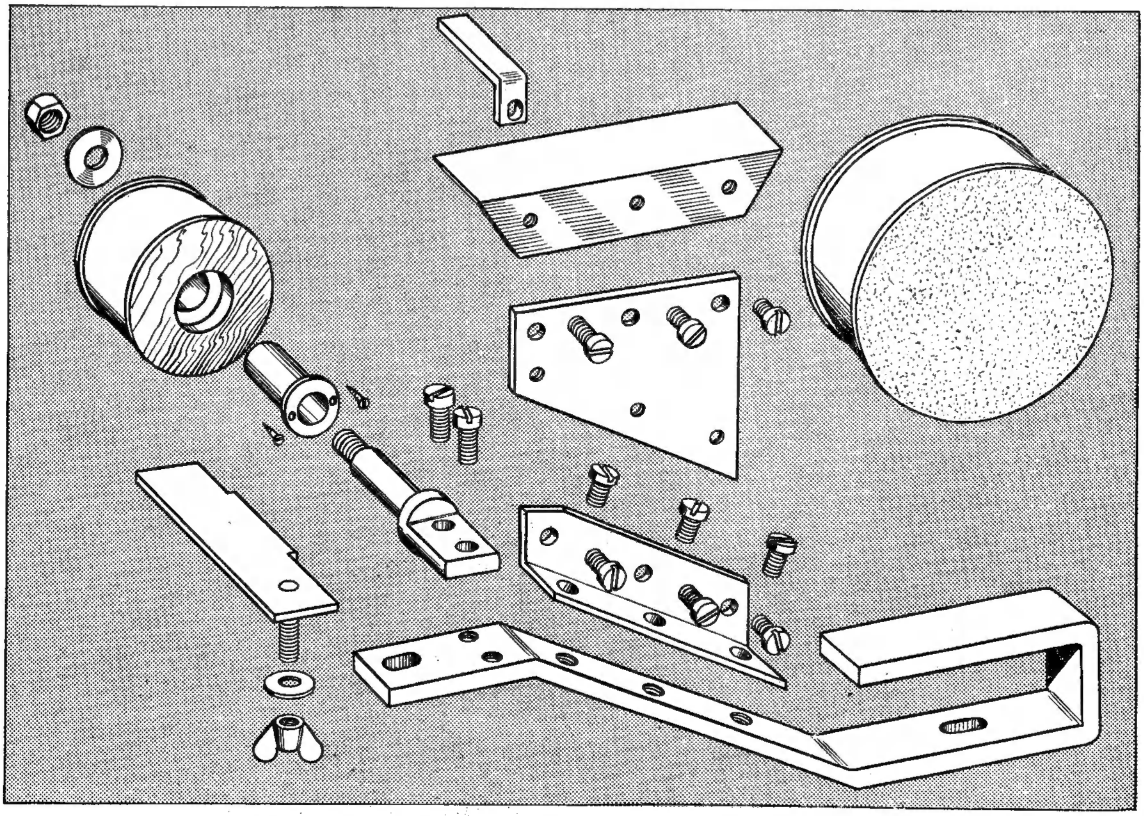


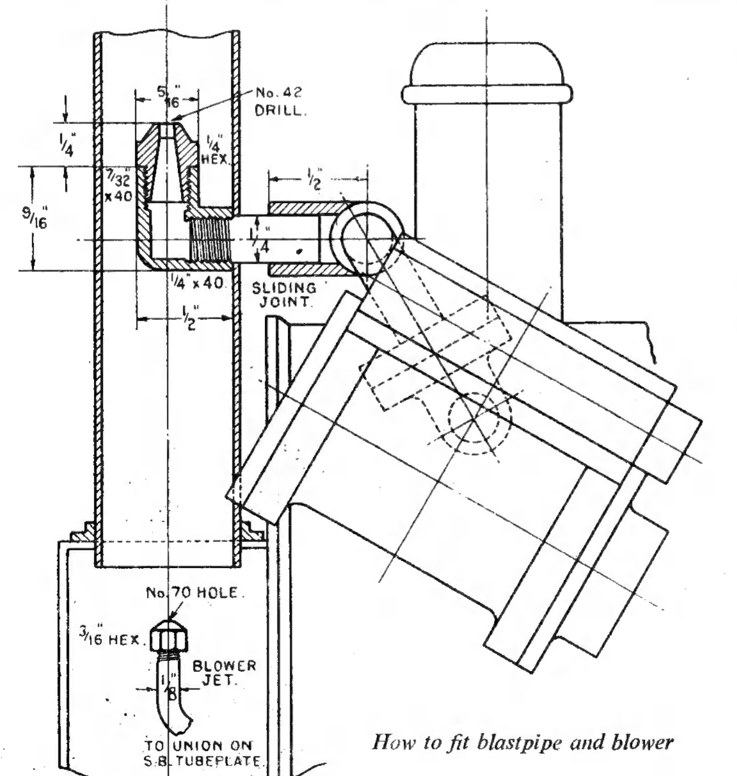
Fig. 8. The completed attachment ready for assembly

L.B.S.C.'s "Canterbury Lamb" in 3½ in. Gauge

● ARRANGEMENT OF EXHAUST PIPE

THE actual exhaust pipes on " ye olde *Mayde of Kente* " weren't much of a problem, the main layout being a simple cross pipe with a tee, as on most engines ; the only ticklish bits were the blast pipe connection, and the necessity for providing an instantly detachable joint, that would allow the smokebox front to be easily removed, without unscrewing unions, or breaking flange joints. These requirements were provided for, in the simple manner shown in the illustrations. The cross pipe and tee are made up as a single unit, with oval flanges at the ends of the pipes. Special elbows, easily made, are screwed into the exhaust holes in the bolting faces of the cylinders, the upper part of the elbows being shaped to match the flanges on the cross pipes, to which they are screwed. The stem of the tee has a reamed hole in it, and is arranged horizontally; the ductility of the copper cross pipe allows of a little flexibility for adjustment.

An elbow is located inside the chimney, and is tapped to carry a special blast nozzle, which screws into it, instead of on the outside, as with the usual arrangement of blastpipe. A short piece of tube is screwed into the horizontal part of the elbow, through a hole drilled in the side of the chimney, and this is silver-soldered in place, as the elbow need not come out any more, once it is fitted. Blast nozzles can be changed, if required, by aid of a long box-spanner, made from a bit of copper tube, put down the chimney. The short piece of tube is lined up with the tee; and when the smokebox front, complete with chimney and blastpipe, is put in place, the tube enters the tee, and forms a sliding joint. At the same time, the bottom ends of the chimney stay rods (which our nautical friends would probably call " guy ropes ") enter two small brackets attached to the boiler. Stay rods are not needed on the little engine; but oh boy ! what WOULD Inspector Meticulous say if I had left them out ! ! As the blower jet isn't fixed to the smokebox front in any way, it just " stays put " when the front is removed.



How to fit blastpipe and blower

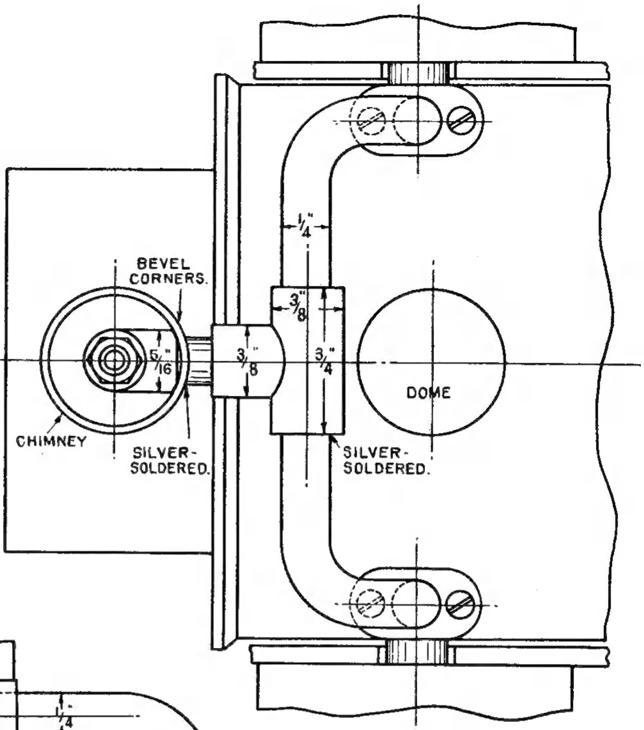
Elbows and Flanges

The elbows can either be cast, or built up. If cast, they should have a chucking piece cast on, opposite the spigot which screws into the cylinder (" Dinna fash yersel' aboot that ! " comes drifting over the air from the direction of Milngavie) and if this is held in the three-jaw, the spigot can be turned and screwed to the sizes given in the sectional illustration. Face the end, centre, and drill No. 21 for about ½ in. depth. Smooth off the top of the flange, and put a 3/16-in. drill down the middle, until it breaks into the horizontal hole.

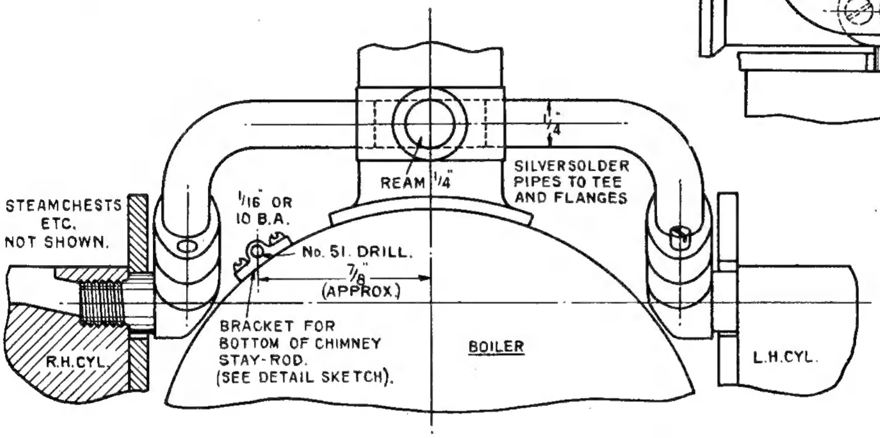
To build up, each elbow needs a piece of brass of ⅜ in × ¾ in. section, and just under ⅝ in. long. This is filed to the shape shown in the detail illustration; and at ⅜ in. from the end which forms the bolting flange, drill a 7/32-in. hole. In this, fit and silver-solder a screwed spigot made in the same way as the union screws described for the boiler fittings; but leave a ⅛-in. flange between the spigot and the screwed part, and the end of the screw need not be countersunk, see section. Drill a 3/16-in. hole in the body part, to form the " thoroughfare," same as mentioned above for the casting.

As it would be awkward to drill and tap these elbows for the flange screws when in position, make the pipe flanges right away; they are merely pieces of ⅛ in. brass plate, filed to the shape of the upper part of the elbows. Drill a ¼-in. hole in the middle of each, for the pipes, and two No. 40 holes for the fixing screws, at ½ in. centres; then fit a flange to each elbow, using the screwholes in the flanges to locate the tapping holes in the elbows.

Mark which flange belongs to each elbow, so that they will fit O.K. when the pipes are silver-soldered in. The elbows can then be screwed into the cylinders, for which purpose the cylinders will have to be temporarily disconnected and removed, but that isn't a very great hardship! The elbows should be in the position shown, when the spigots are right home, with the shoulder tight against the bolting face; according to the protractor on my drafting machine (left to me by the late and lamented "Bro. Wholesale") the angle is 60 deg. from the horizontal. If the elbows are not jammed tight at this angle, don't lose any sleep over it. They can't come out, and when the cross pipe is in place, they won't stand much chance of shifting; so why worry? Unofficial history tells us that worrying over a mouse that escaped, once killed a cat! When the cylinders are replaced, the lower part of the elbows should just clear the boiler.



Plan of exhaust pipes



(Left). Front view of exhaust pipe assembly

Cross Pipes and Tee

Better make the tee first (pause here for a cup of the enginemen's best friend; that's a subtle one!) and the pipes can then be fitted to it, and cut to correct length right away. If a casting is used, just chuck by one end of the crosspiece, face off, centre, and drill right through with letter "C" drill if available; if not, use 1/4 in. Face off the other end. There should be a chucking-piece opposite the stem; grip this in the three-jaw, set the outer end to run truly, face, centre, and drill 15/64 in. or letter "C," right into the cross hole; ream 1/4 in. Smooth the outside with a a file, if it is very rough, but don't be too particular; the original builders weren't!

To build up, either use two pieces of 3/8-in. × 16-gauge tube, or two pieces of 3/8-in. rod, one 3/4 in. length and one 1/2 in., both drilled as above. Saddle the short piece to the longer piece, tie in position with iron binding wire, and silver-solder the joint. Use a coarse grade of silver-solder, such as Johnson Matthey's B6 alloy. Drill down the stem, into the cross hole, with 15/64-in. drill, and ream 1/4 in.

Kinked pipe bends not only look what the kiddies call "worse'n awful," but are evidence of bad workmanship. To make certain the bends shown in the illustrations, are neat and kinkless, it would be advisable to fill the pipes with lead, and melt it out after the bends are made. I have some lead wire of different thicknesses, made for the job; and if I want a very sharp bend, all I have to do, is to insert a piece of lead wire into the pipe, same diameter as the bore; bend the pipe either on my bending machine, or over a piece of suitable diameter rod held in the bench vice, and melt out the lead after bending. In the latter case, sufficient hand leverage is obtained by putting a piece of larger diameter pipe over each end of the piece to be bent. Where the bends come near the end of the pipe, as in the present instance, sufficient extra pipe has to be allowed, to get a "grip"; and it would appear at first sight, that waste of pipe is unavoidable, but it doesn't necessarily follow that such will be the case. It is a paradox, that the more pipe allowed each side of a sharp bend, the less is wasted; for if long pieces are cut off, they will probably come in for something else. If short bits

are cut off, they may be *too* short for further use, although I have frequently joined two short lengths of pipe by a neat socket silver-soldered over the join, and used the result in some place where the join was inconspicuous, vot you tink, eh? Hoots, mon, awa' wi ye!

Anyway, hold the tee in the position shown in the drawings, measure from tee to elbows on cylinders with a bit of soft wire, cut the pipes to the lengths indicated, and attach to flanges and tee. If the latter is a casting, all joints in the whole assembly can be silver-soldered, but if the tee is built up, silver-solder the flanges only, and soft-solder the pipes into the tee. There is very little heat and pressure to withstand on the exhaust side, and soft-tommy will be quite all right. The flanges are attached to the exhaust elbows by two screws apiece, as shown.

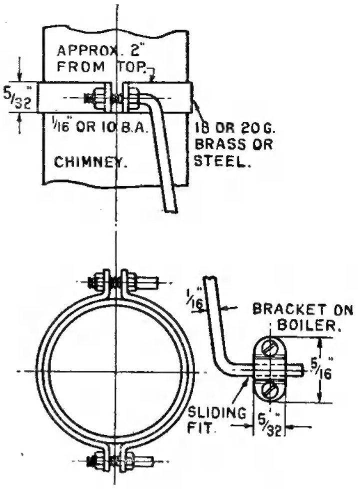
Blast Elbow and Nozzle

The elbow carrying the blast nozzle may be cast, or filed up from a piece of brass rod of $\frac{1}{2}$ in. × $\frac{5}{16}$ in. section, and about $\frac{5}{8}$ in. long. If the latter, be sure to round off the lower part as much as possible, to prevent any deflection of the jet of steam issuing from the blower nozzle when same is in use. The longer part of the elbow, which is vertical, is drilled $\frac{3}{16}$ in. and tapped 7/32 in. × 40 for the nozzle. The horizontal part is drilled 7/32 in. and tapped $\frac{1}{4}$ in. × 40 for the stub of $\frac{1}{4}$-in. copper pipe that forms a sliding joint with the tee. The corners of this must be bevelled off with a file, to allow the nozzle to come central with the chimney; see plan view.

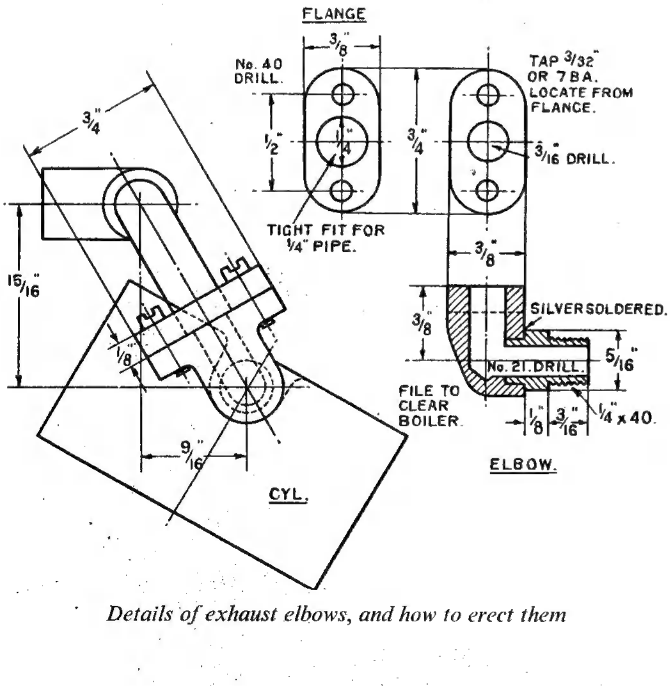
Put a little piece of $\frac{1}{4}$-in. round rod or tube, in the stem of the exhaust tee. Put the smokebox front in place, making sure that the chimney is quite vertical. Pull the bit of rod out of the tee, until it touches the chimney, and scribe a line around it, on the chimney. That gives you the exact spot to drill the hole for the connecting pipe, so that it will enter the tee when the smokebox front is put in place. Carefully centrepop the circle, and drill a 7/32-in. hole, which should be central with the circle. If it isn't, teach it good manners with a small rat-tail file, then enlarge with a taper broach or reamer until a $\frac{1}{4}$-in. pipe enters a very tight fit. Put a few threads on the end of the pipe, and cut it off a full $\frac{11}{16}$ in. from the end; then chuck in three-jaw, blank end outward, face the end, and bevel slightly, so that it enters the tee easily. Now put a few threads on the end of a bit of 7/32-in. rod or tube, anything over 6 in. long. Screw the elbow on to it, and poke it down the chimney until the other hole in the elbow is opposite the hole in the chimney. Screw the short pipe into the elbow, through the hole in the chimney; then pack something around the bit of rod or tube carrying the elbow, so that it " stays put " in the middle of the chimney. Asbestos string may be used; or a wood or metal plug with a $\frac{1}{4}$-in. hole in it, may be put into the chimney, the tube passing through the hole. Finally, silver-solder the tube to the chimney; the silver-solder will penetrate, and fix the elbow to the inside of the chimney as well as fixing the tube. Remove the rod; pickle, wash off, clean up, and fit a blast nozzle made from $\frac{1}{4}$-in. hexagon rod as shown. Drill the tip 3/32 in. or No. 42, for a kick-off; it can be adjusted afterwards if necessary. I haven't had much experience with blast nozzles in long chimneys; but my old extension chimney with an air nozzle inside, used as a steam raiser, made a lovely draught with little air, so maybe the boiler will steam too freely with the usual size of nozzle, and it may have to be opened up a bit. Ream the screwed end of the nozzle to a taper as shown.

An Easily Made Spanner

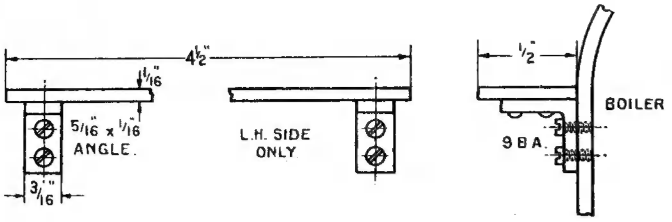
A long box-spanner is easily made by driving a scrap of $\frac{1}{4}$-in. hexagon rod into the end of a 6 in. length of brass or copper tube, and hammering same on to the flats of the hexagon. The hexagon part only needs to be about $\frac{1}{4}$ in. long. If the little blast nozzle is jammed in the end of this, it will be an easy job to screw home the nozzle. As to the blower jet, this is merely a weeny edition of a blast nozzle screwed on the end of a bit of $\frac{1}{8}$-in. copper pipe, the other end being furnished with a nut and cone, for attaching to the thoroughfare nipple on the smokebox tubeplate. It should be set under the chimney, as shown in the side view of the pipe assembly.



Chimney stay-rods



Details of exhaust elbows, and how to erect them



Driver's footboard

That completes the working parts of the engine; and if the smokebox front, complete with chimney and "biscuit tin," is pushed into the end of the boiler barrel, the stub of pipe projecting from the chimney, should enter the tee as shown, and "complete the circuit," as Milly Amp would remark.

Stay-rods and Footboard

All we need to finish the engine part, are the chimney stay rods, and the driver's precarious perch. The latter may have been all right for old Teddy Fletcher in 1830, at little more than walking pace, and not enough breeze to blow his top hat off; but Tom A. Beckett of 1984 would have to cling on for dear life, as the reincarnated old girl dashed across the fields with her skirt well above her knees, and a mile-a-minute gale blowing through Bro. Thomas's grey whiskers, to the great delight of the kids in the train !

So Simple !

The clip securing the stay rods to the chimney is simplicity itself, the drawing showing it clearly. Two 5/32-in. strips of metal, about 18- or 20-gauge, are bent into half-circles like parts of eccentric straps, the ears or lugs being drilled No. 51. This is located about 2 in. below the top of the chimney, and secured by nuts on the bent over ends of the stay rods, as shown, which are made from $\frac{1}{16}$-in. steel wire. Two brackets are filed up to the shape shown, from 5/32-in. or $\frac{3}{16}$-in. square brass, drilled No. 51, and attached to the boiler, as shown in the end view; one on each side, naturally. The stay rods slope down from the clip, at approximately the angle shown in the general arrangement drawing published with the first instalment; they are bent at a sharp angle at the bottom, to enter the holes in the brackets, and should project $\frac{1}{4}$ in. or so beyond them. Round off the ends for easy insertion. When the smokebox front is pulled off, for any purpose, the stay rod ends just slide out of the brackets, being pushed through again when the front is replaced. Instead of the stay rods holding the chimney, as on the full-sized engine, the chimney holds the stay rods !

There is only one footboard, on the left side of the boiler, located at half the barrel height. It consists of a $4\frac{1}{2}$ in. length of 16-gauge metal, $\frac{1}{2}$ in. wide, and is secured to the boiler by two pieces of $\frac{5}{16}$ in. × $\frac{1}{16}$ in. angle, $\frac{3}{16}$ in. long, riveted to the footboard by $\frac{1}{16}$-in. rivets, and attached to the boiler barrel by two 9-B.A. brass screws in each bracket. The heads of these screws, and the brackets, should be sweated over with soft-solder, to prevent leakage, same as the expansion brackets holding the rear end of the boiler, and the brackets at the bottom of the stay rods. There is little hold for even $\frac{1}{16}$-in. screws in 18-gauge copper, and the vibration may well cause them to work loose if not soldered over. The brackets could be bent from $\frac{3}{16}$ in. × $\frac{1}{16}$ in. strip metal.

No Whistle

The ancient old lady herself has no voice; not by virtue of catching 'flu through standing outdoors all through the years, but because steam whistles were not invented until a train on the Leicester and Swannington Railway hit a cartload of butter and eggs on a level crossing. It was a wonder that the carter didn't hear the train coming along, as the locomotives of those days kicked up such an infernal clatter; but anyway, the world hasn't changed much—something *still* has to happen, before anything is done to prevent it ! However, if anybody wants to fit a whistle to the little engine, one of my usual pattern, described for *Tich* and other engines, can be placed below the footboard, and attached to it by two simple clips. Make a whistle-valve as for *Tich*, minus the two $\frac{1}{4}$-in. union screws, and screw it into the boiler, on the opposite side to the blower fitting. Connect the small union on the valve, to the union on the whistle, by a $\frac{1}{8}$-in. pipe. The drawgear can be left until the tender is completed; and the latter will be the next job.

Tail Lamp

In view of the notice that "Correspondence must be addressed to the Editor, and not to individuals," several correspondents want to know if that puts the bar up to anybody writing direct to me, and whether their locomotive queries now be sent to the "Queries and Replies" department. Not on your life ! I have nothing whatever to do with the department mentioned, and their ideas on locomotive subjects don't necessarily agree with my own practice and personal experience ; so anybody who wishes to take advantage of the latter, can do so—as they have done for the past 28 years—by writing either direct to my private address, or care of our offices ; but please don't forget the return ticket !

A Belt and Disc Sander

(*Continued from page* 318)

pulleys as close together as the slot in the frame will allow. Fit the belt in this position. Belts are made up from emery strip obtained from engineers' stores, in various grits and widths. The belts are joined by cementing both ends to a piece of thin strong canvas on the under side. The belt is tightened by moving the frame across the lathe bed and locking tight again. If one is not conversant with using a sander of this description, care should be taken at first in not applying too much pressure to the work, as these sanders will remove a lot of metal in a very short time, and quite possibly spoil a job. The attachment will be found a great help in the workshop, and the time saved in finishing small work will more than compensate for its construction. All polished parts should be kept well oiled as a safeguard against rust, and the wood pulley sides should be painted.

USING MODELS FOR HULL DESIGN

By A. G. Thomson

THE idea of using models for designing ships is more than 300 years old, for primitive tests of this nature are described in an early 17th century manuscript now in the British Museum. Due to ignorance of the laws of motion and resistance, however, the early experimenters failed to achieve any worth-while results. To a great British inventor belongs the credit for developing an accurate and scientific method of predicting a ship's performance from model tests.

More than seventy years ago William Froude successfully followed up the work of previous investigators and showed how existing theories of wave formation, frictional resistance, etc., could be pieced together with certain adaptations to give a complete picture of the resistance of a ship. Froude experimented with models 6 ft. long, which were towed by a launch on the river Dart. These experiments led to the discovery of Froude's Law, which states that the flow of water and pattern of waves round a ship and an accurately shaped model, will be precisely the same, provided that the speeds of both ship and model have a definite relationship governed by the model scale. If the ship is 25 times the size of the model, this similarity of behaviour will exist if its speed is the square root of 25 : i.e., five times that of the model. The resistance of the ship due to the energy lost in making waves will be the cube of 25, or 15,625 times that of the model.

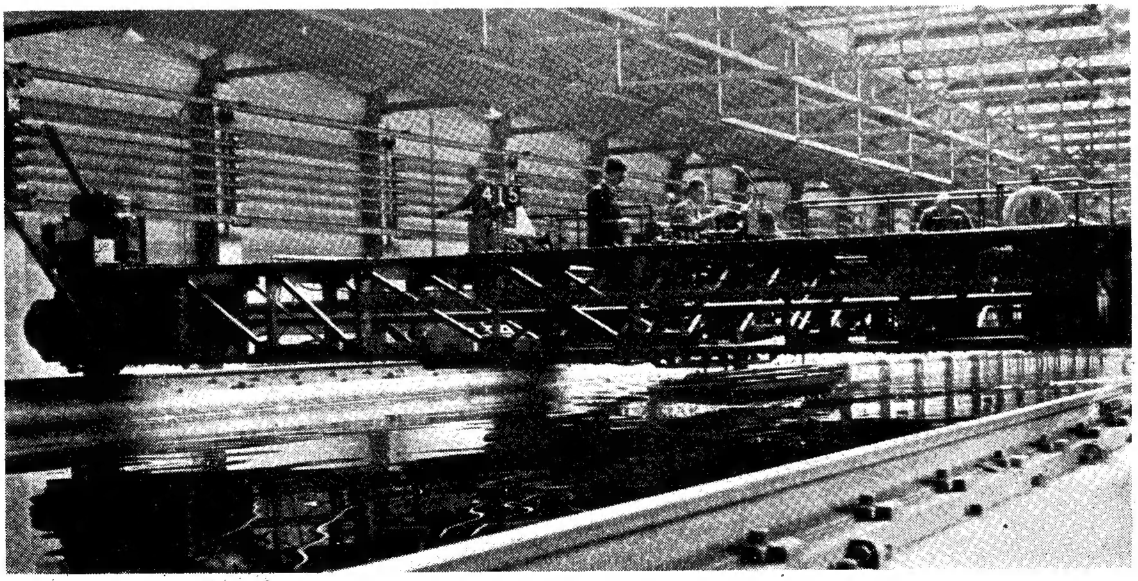
Experimental Tanks

The same general laws also apply to screw propellers. If a model screw propeller is rotated behind a hull model pulled through the water at a given speed and with the required ratio of revolutions to speed, the flow of water and other conditions will be similar to those encountered by the actual propeller, and there is a definite mathematical relationship between the forces required to drive the propeller and its model, depending on the scale of the model.

Nowadays it is standard practice to test models of ships in experimental tanks. The Admiralty and several leading shipyards have their own tanks, but most shipbuilders have their models tested at the Ship Division of the National Physical Laboratory before construction starts. Among the models tested by the Ship Division was that of the new *Mauretania.*

In 1908 the laboratory received a gift of £20,000 from the late Sir Alfred Yarrow for the construction of a tank which could be used for research directed to the improvement of ship design and propulsion, and in which tests could be made for the information of shipbuilders and owners. This tank is a concrete basin over 550 ft. long by 30 ft. wide, the depth of water in the centre being 12½ ft. In view of the increasing demand for tests, the Government eventually provided funds for the construction of a second tank, which was completed in 1932. This tank is 678 ft. long and 20 ft. wide. For a distance of 446 ft. the depth of water is 9 ft., but a feature of the tank is a stretch of 177 ft. having only 2 ft. of water, so that the investigators can study the effects of shallow water on resistance, steering, etc. The equipment includes apparatus for producing waves, which is used for studying the performance of models in rough water.

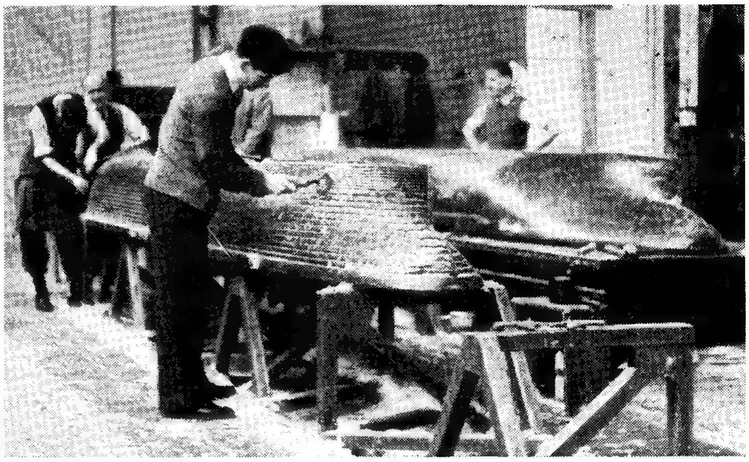
Models are produced in paraffin wax, which is first cast in a clay



No. 1 *tank carriage with model under test*

moulded to the required form and then shaped with a special cutting tool to reproduce exactly the lines of the ship as designed. By this means the models are rapidly and accurately made, and the form can be readily altered if it is desired to ascertain the effect of suitable modifications on the hull. The models range from 15 to 24 ft. long and when ballasted to scale, weigh 2,000 to 3,000 lb.

The model under test is towed by an electrically-propelled carriage which spans the tank and runs along carefully levelled rails. Including the time taken to make the model, an entire series of tests for resistance at various speeds can be completed within a week, the data obtained enabling the horse power required to drive the ship at the corresponding speeds to be mathematically ascertained.



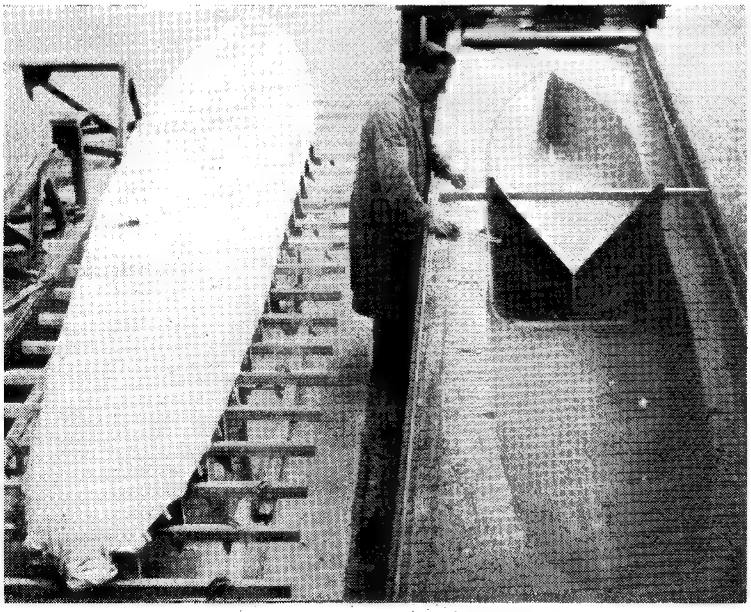
Scraping the wax hull

Propulsion Tests

These are carried out by fitting a model propeller to the model hull, which is towed through the water as before. The propeller is driven by a self-recording electrical apparatus fitted on the model, which gives continuous records of the screw thrust, the torque on the shaft, revolutions and speed, etc. From this data the efficiency of the ship's propeller can be assessed.

All experiments are carried out by highly trained men whose skill in interpreting the results of model tests is supplemented by first-hand knowledge of the behaviour of ships at sea. From their observations of the models under test, these experts are frequently able to suggest modifications which should give improved results. These modications are incorporated in the model and the tests are repeated until optimum performance has been achieved. Not infrequently the efficiency of the design has been improved by 20 per cent. or even 30 per cent. as a result of the tests.

At the end of the tests the designer has all the data he requires to achieve his aims. He knows that the propeller will work efficiently at the desired number of revolution and give the ship the desired speed without risk of a break-down when the vessel is heavily loaded in bad weather. He can calculate the power required from his main engines to drive the propeller and the margin which should be added to provide a safe reserve for storms and other contingencies. All this essential knowledge has been gained in a few weeks at the cost of perhaps less than one-tenth of one per cent. of the contract price of the vessel.

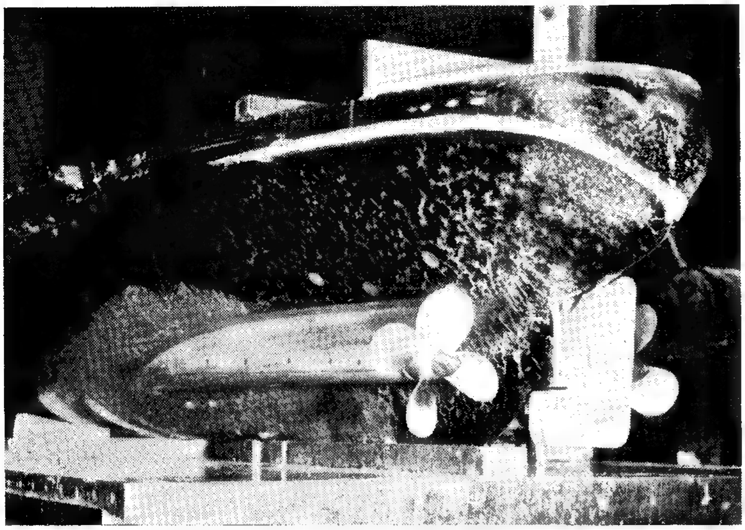


Showing a clay model with core alongside

A Water Tunnel

The Ship Division of the National Physical Laboratory is also equipped with a water tunnel in which cavitation effects on model propellers are studied. Cavitation is the production of cavities on the front or back of a propeller blade due to the high suction induced by the water flow. This condition cannot be reproduced in the open experimental tank, because it is impossible to reduce the air pressure to a level corresponding to the scale of the model. Air at the desired pressure is admitted to the tunnel from a chamber located above the water. The water is circulated past the model propeller, which is rotated under precisely the same conditions as a ship's propeller advancing through the sea. If the test shows that cavitation will occur, it may be necessary to redesign the shape of the blade sections and to provide more blade area, in order to prevent loss of efficiency and erosion of the blades on the ship propeller.

According to G. S. Baker, ex-



Stern of twin-screw model, showing propellers, bossing and rudders

perimental work on model ships during the past thirty years has reduced the resistance of merchant ships by an average of 15 per cent. and has increased propeller efficiency by at least half this amount. Since 1911 the work of the Ship Division of the National Physical Laboratory has greatly increased available knowledge regarding the influence of hull form on ship resistance and propulsion, the effect of waves, the design of propellers, the wind resistance of the ship's superstructure, the steering and manoeuvring of ships, and many other problems. Knowledge gained from research and from individual tests carried out for firms has led to material improvements in form of hull and means of propulsion, with correspondingly large reductions in fuel consumption and running expenses. British ships are renowned for their high standard of performance in rough weather.

Upper Deck Changes

Experiments with models have also brought about far-reaching changes in the distribution of superstructures and deck houses on upper decks. The laws of motion of a fluid round a body are the same for both air and water. It follows that when a model is towed through the water upside down, the water flowing past the superstructure will obey the same laws as the wind flowing past the ship. The hull can be set at various angles to the direction of motion in order to simulate side winds, etc., the speeds being kept low enough to avoid making waves. Allowing for the high density of water, which at normal temperatures is 830 times that of air, the effects of varying the shapes and grouping of superstructures can be determined. These experiments—together with the development of new structual materials, the transition from coal to oil, and various other factors—have brought about a notable change in the profiles of both passenger and cargo ships, besides enabling a far higher proportion of deck space to be economically used.

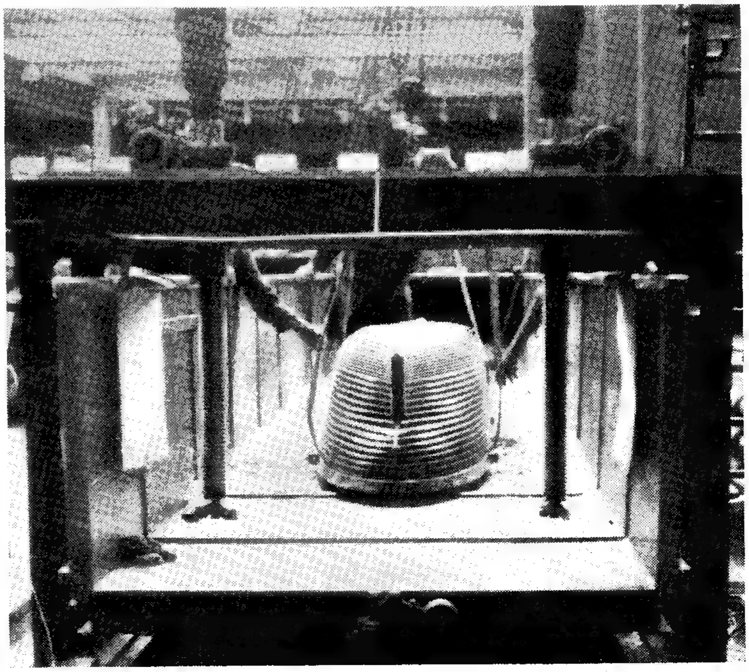
Seaplane Floats

Apart from research and tests on ships, the tanks at the National Physical Laboratory have been extensively used for experimental work on seaplane floats and flying boat hulls, in order to investigate the motion of seaplanes before leaving the water and on alighting.

War-time Tests

During the war many special problems were investigated in these tanks, such as the production of "straight frame" ships from sections prefabricated in inland factories. The Ship Division also assisted in the development of the Mulberry Harbour and Pluto pipeline. The main units of the harbour had to be towed at considerable speed without yawing, and had to be fully under control at every stage of the operation. Hundreds of tests were carried out before a completely satisfactory design was evolved.

The photographs illustrating this article are supplied by the Ship Division of the National Physical Laboratory, and are Crown copyright.



The wax hull in a cutting machine

In the Workshop...

MAKING A DRAUGHTING MACHINE

BY DUPLEX

NOW that most of the moving parts of the machine have been made, they can at this stage be assembled before going on to fitting the protractor and the set-square.

Fitting the Joint Screws (Fig 11)

As shown in the previous illustrations of the upper and lower pairs of connecting arms, the joint-pin holes are countersunk to an included angle of 60 deg., after being drilled for the 6 B.A. pivot-screws. The countersinking can be accurately done with a Slocombe centre drill and, with careful feeding, a good surface finish will be left.

The dimensions of the eight screws required are given in Fig. 5, and a sectional drawing of a joint will be found in Fig. 11.

As the smooth-working and good-wearing qualities of the joints depend largely on the finish given to the bearing surface of the screws, these parts are made of silver-steel and are machined to the correct head angle by setting over the lathe top-slide. A joint made up of a silver-steel pin working in a mild-steel arm is much less liable to scoring than one with a mild-steel joint pin.

A knife tool with a narrow cutting edge, set at exactly centre height, should be used for machining the coned heads of the screws. Run the lathe at high speed, and use plenty of cutting oil while feeding the top-slide slowly and evenly along the work.

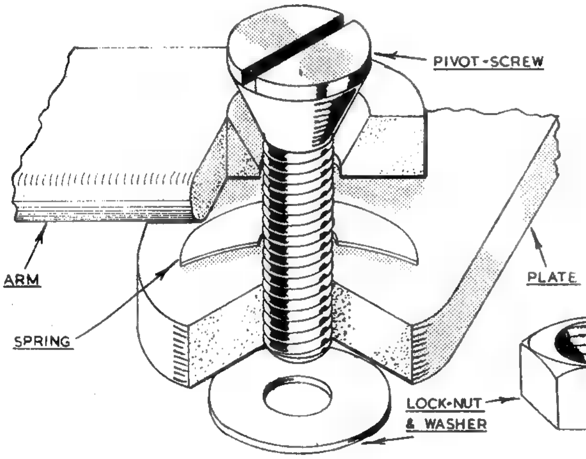


Fig. 11. Showing position of the assembled joint parts

The screws may be given a high finish by polishing with a small emery stick, but care must be taken not to upset the accuracy of the bearing surfaces. For the attachment of the connecting arms, the paired holes in the link bar, the fulcrum plate, and the head plate are now tapped 6 B.A.

To form shakeless joints, and to take up any wear that may arise in use, a spring washer is fitted to each screw between the arm and the plate, as represented in Fig. 11. Stellate, spring-steel washers of the right kind are used in instrument work, but so far these have been unobtainable. Belleville washers of the commercial pattern are rather too stiff-acting. Satisfactory washers can, however, be made quite easily from spring brass strip or sheet. The successive stages in making the washers are shown in Fig. 12, and to finish the washer it is given a curved set to supply the spring action. At the time of assembly, the joint should be lubricated with a light smear of thin grease and, after the screw has been tightened to take up the play, the joint is secured by tightening the lock-nut.

It now remains to make and fit the set-square assembly carrying the protractor and the two rules.

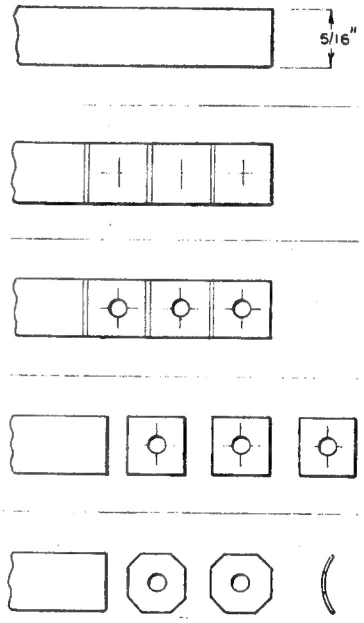


Fig. 12. Stages in making the spring, joint washers

The Clamp Knob (G, Fig. 13)

An exploded view of the complete head assembly is shown in Fig. 14. The finger knob for clamping the set-square assembly to the head plate was made from white catalin rod, but any other plastic material or ebonite will do equally well.

Concluded from page 283, *February* 26, 1953.

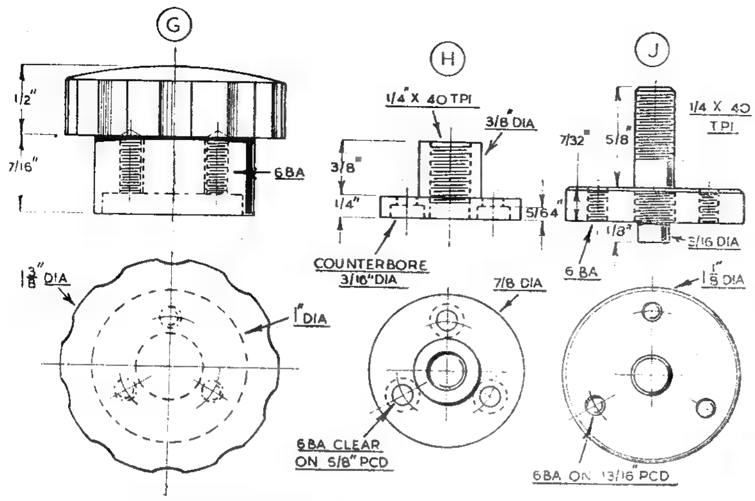


Fig. 13. "G"—the clamping-knob ; "H"—the inset bushing ; "J"—the head spindle and collar

The knob is recessed to take the brass, inset bushing (*H*), which is secured in place by three 6-B.A. screws. Although the bush is threaded ¼ in. × 40 t.p.i., ¼ in. B.S.F. can, if preferred, be used for this and its mating part (*J*).

The Head Spindle Assembly (J, Fig. 13)

The spindle for the knob (*G*) is made of mild-steel and has its lower end reduced to 3/16 in. dia. to form a register for mounting the set-square.

The spindle is screwed firmly into a 1⅛ in. dia. brass collar for attaching the protractor and set-square assembly.

The three 6-B.A. tapping-size holes are not tapped at this stage, as the part (*J*) is used later as a drilling jig.

The Protractor (K, Fig. 15)

The smallest commercial protractor, so far obtainable, is 4 in. in diameter, but this is needlessly large for the present purpose, and a diameter of 2½ in. is enough. An instrument scale of this size was found for one of the machines made, but the other is fitted, as a makeshift, with a circular scale divided into 200 divisions. There is, however, no great difficulty in making a protractor specially for the machine. Either clear or white celluloid, 3/64 in. to 1/16 in. in thickness, will probably be found best as, when marking the figures, this material can be punched with a hand stamp without splitting. The celluloid is first marked out and then cut roughly to shape. After the centre hole has been drilled to form a good fit on the lower end of the head spindle, the material is clamped to the collar or part (*J*) with toolmaker's clamps so that the holes for fixing-screws will be accurately located when drilling. Mark both parts with a scriber for future reference at the time of assembly. Fix the celluloid to a flat piece of wood with wood screws, and mount this on the lathe faceplate with the central hole set to run true.

After the disc has been turned to the finished diameter, a V-tool of 30 deg. to 45 deg. included angle is mounted on its side at centre height in the toolpost. If no dividing head is available, the dividing to 90 deg. on either side of the zero-line is carried out by means of a 60-T. wheel secured to the lathe mandrel. The divisions will be more widely-spaced and less work will be required if increments of 2 deg. are used. For this purpose, as shown in Fig. 16A, a 20-T. wheel, controlled by a detent, is meshed with the 60-T. wheel, and the backlash is taken up by means of a suspended weight attached by a cord to the chuck key. Where every degree is indexed, the 20-T. wheel is meshed with the 60-T. wheel, and on the same stud a 50-T. wheel is mounted to engage the 25-T. wheel controlled by the

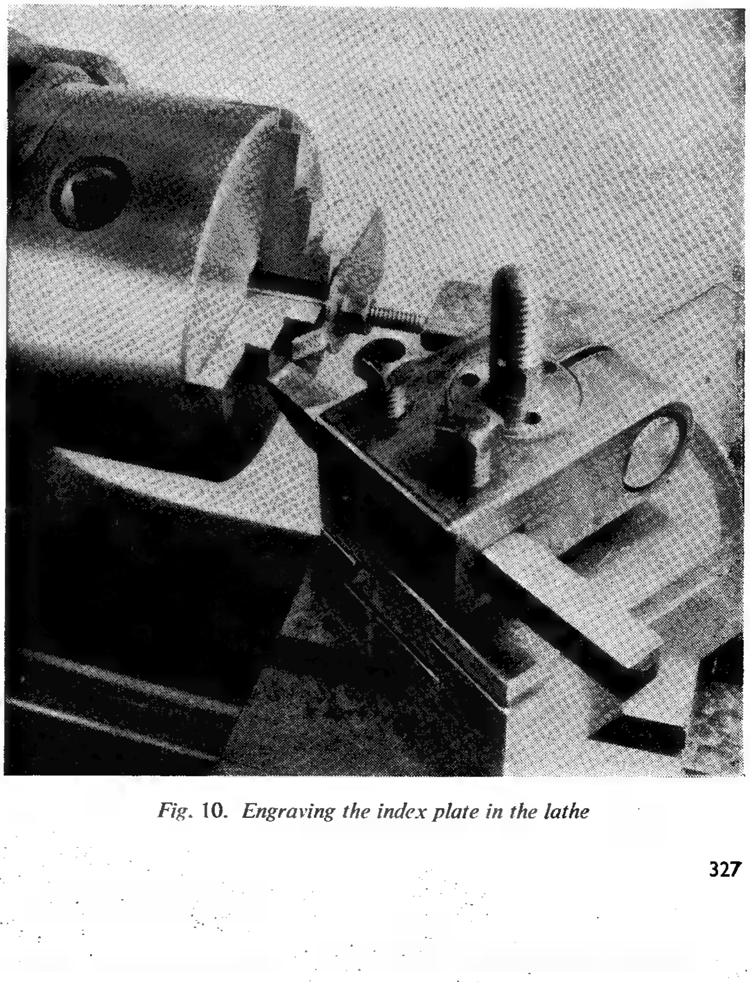


Fig. 10. Engraving the index plate in the lathe

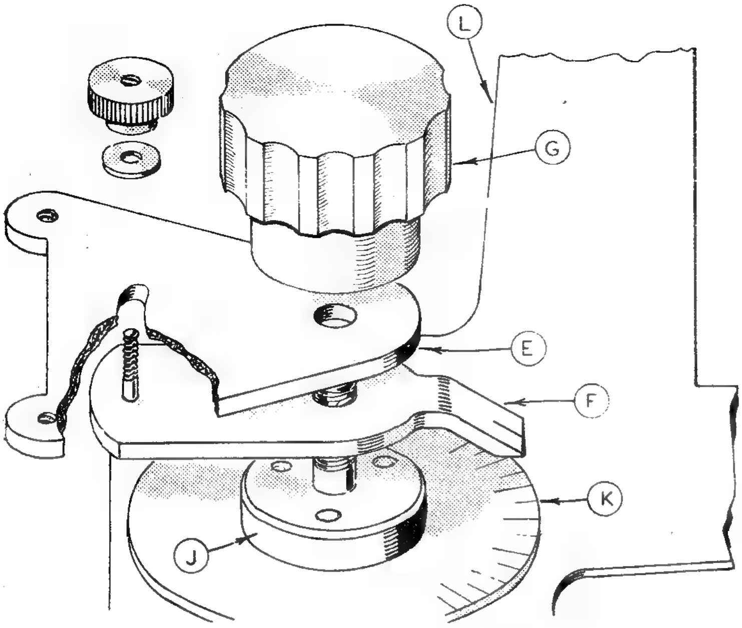


Fig. 14. Exploded view of the head assembly

detent, as represented in Fig. 16B. The scale lines are now cut to a depth of some 4 thousandths of an inch by feeding the cross-slide inwards ; the length of the lines is best copied from a standard scale or protractor. The figures can be readily marked with figure punches, and the markings will be more easily read if they are afterwards filled with indian ink or with a wax preparation specially made for the purpose.

The Set-square (L, Fig. 15)

Sheet ebonite or plastic material will serve for making the set-square, but plastics such as Perspex are preferable, as they are less brittle and do not tend to warp.

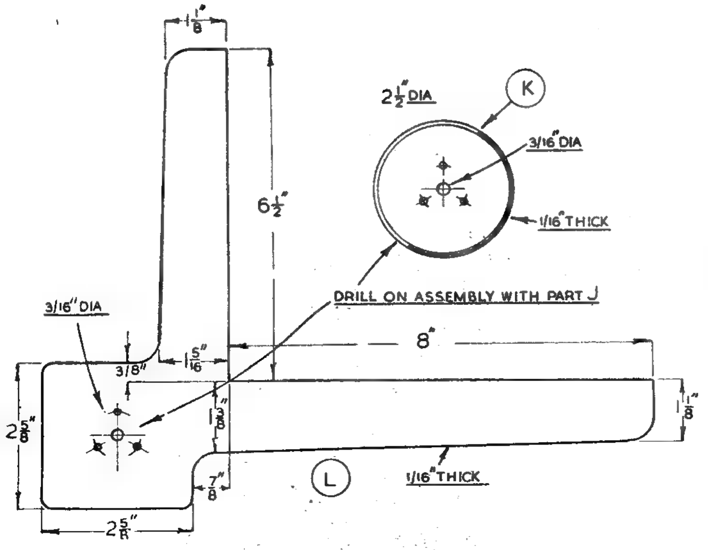


Fig. 15. "K"—the protractor blank ; "L"—the set-square

The material is marked-out and cut to shape, but the right-angled profile should be afterwards checked from time to time, as some distortion may occur where internal strains have been liberated by shaping the material. After the hole for the head spindle has been drilled, the holes for the attachment screws are jig-drilled from the spindle collar, as when drilling the protractor ; but make sure that the zero-line of the protractor is correctly positioned and that all parts are marked to ensure correct re-assembly.

The Rules

The two rules, shown in Fig. 1 attached to the set-square, are not really necessary, but they add to the appearance of the machine and will be useful for laying off dimensions or setting the drawing instruments. White ivorine rules are fitted and are attached to the set-square with

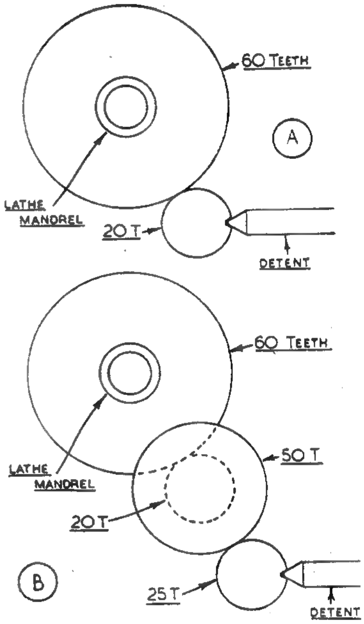


Fig. 16. "A"—wheel train for indexing graduations of 2 deg. ; "B"—indexing in degrees

No. 8 B.A. duralumin screws specially made for the purpose.

Assembling the Head Fittings

The three holes in the collar of the head spindle are tapped 6 B.A. and the holes in both the protractor and the set-square are now opened out to the clearing size ; the latter holes are then countersunk on the lower surface.

(*Continued on page* 335)

READERS' LETTERS

Letters of general interest [illegible] all subjects relating to model engineering [illegible] welcomed. A nom-de-plume may be used if desired, but the [illegible] and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

EJECTOR PUMPS

DEAR SIR,—In your reply to E.H.E. of Longton, page 188 of No. 2698 ; you state that laboratory filter pumps are usually made of glass. This is true, but Messrs. Edwards of London (The Vacuum people) make a metal one, and a plastic one is made by George and Beckes of Birmingham.

The rubber connection should be either wired to the water tap or a Jubilee type clip used. The rubber tube is often covered with a layer of electrician's black tape.

Yours faithfully,
E.W.

E. ANGLIA'S FIRST STEAMBOATS

DEAR SIR,—Arising out of the final form of my article under the above heading in your issue of January 29th last, there are one or two points which, for the sake of historical accuracy, I would like to correct. For example, there is no reference to Fig. 1 in the text, as this was not amended in the corrected proof. It should, of course, appear at the end of line 40 in column two.

Fig. 1 itself does not illustrate the style of finish as used by Murray, and which was typical of this period. Murray never finished so many parts in a highly polished state. Never was [illegible] large flywheel machined and polished on three sides of the rim. The same can be said of many other parts including the cylinder covers. The " atmosphere " of the original is lacking and is that elusive thing I had hoped to convey to the reader when studying Fig. 2 and 3. It may not seem apparent at first glance, but an inspection of the Trevithick engine in the Science Museum will illustrate my meaning. Again, no man of Murray's standing would include an aperture in the foundations where three blocks of " Yorkshire " are left without any arch, beam or lintel to support them. Mr. Folkard's engine is a fine piece of almost watchmaking craft, but it is not how Murray finished his prototype. The print of the engine I originally submitted would have done so, but apparently it was not good enough for reproduction. But I could have supplied another.

From the philological standpoint the spelling of the first pioneer boat should be *L'Actif*, not as published.

Attached is the time table of the service between Ipswich and Harwich in 1815.

As this is the earliest sailing time table of a regular service I have so far discovered, I think it worth inclusion.

Yours faithfully,
Norwich. RONALD H. CLARK.

THIS PACKET WILL LEAVE

Ipswich on	Monday	next at	9 a.m.	and Harwich	5 p.m.
,, ,,	Tuesday	,, ,,	10 ,,	,,	6 ,,
,, ,,	Wednesday	,, ,,	½ past 6 ,,	,,	2 ,,
,, ,,	Thursday	,, ,,	7 ,,	,,	2 ,,
,, ,,	Friday	,, ,,	7 ,,	,,	2 ,,
,, ,,	Saturday	,, ,,	[illegible] ,,	,,	2 ,,

DEAR SIR,—I should like to express my appreciation of the most interesting article by Mr. Ronald H. Clark on East Anglia's steamboats. The article was most enjoyable reading and would add, I think, to most readers' knowledge of the history of the early steam engine. I hope I will not be misunderstood if I raise a small point of criticism. This refers to the drawing which appears on page 140.

Drive from the engine crankshaft to the paddle shaft is shown to be by single coupling-rod. This would give trouble at top and bottom dead centres. Possibly there were two additional coupling-rods (one on each crank pin) with suitably formed crank shaft above. This would, however, be an expensive construction and I think coupling-rods would not prove very successful in view of the light construction of the boat. I wonder if it is not more probable that the cylinder sloped upwards to the paddle shaft, when all the difficulties would be overcome by the connecting rods driving directly on to the paddle shaft.

Another small point; there appears to be a slight " slip of the pencil " in the elevation, where the return flue looks as if it comes out above the foot of the chimney.

This engine and boiler, installed in a suitable hull, would make [illegible] most unusual, but very interesting model. It would be very simple to make without sacrificing any detail and would also be easy to operate. A normal horizontal blowlamp could fire the boiler. Constructional details would make a welcome series of articles for future issues of THE MODEL ENGINEER.

Another point on which Mr. Clark might throw some light concerns the photograph of his hypocycloidal engine on page 139. The arrangement of the gearing would appear to give one revolution of the flywheel shaft for four strokes of the cylinder yet the slide-valve appears to be of normal type. Perhaps the motion of the valve-rod is controlled by a suitable cam on the shaft instead of the usual eccentric, but this cannot be seen on the photograph.

Yours faithfully,
London, N.6. E. J. HOWLETT.

TUBE BENDING

DEAR SIR,—Most of us, at one time or another, like Mr. Edmeston in your January 1st, 1953 issue, have difficulty in bending tubing of small diameter about short bends without creating wrinkles and buckling.

Here is a simple and foolproof method, which readers may wish to try ; the method gives perfect bends with ¼ in. diameter annealed copper, brass, or aluminium tubing even when wound around a ⅛ in diameter rod.

The procedure is as follows :

(1) Oil coat inside of tube to prevent " tinning."

(2) Cork one end of tube.

(3) Immerse in boiling water.

(4) Pour full of molten Wood's Metal (melting point 160 deg. F.). (This metal, under the trade name of " Cerrobend," is commonly used in this country for holding small and complicated punches in die-making, etc.)

(5) Cool until solidification is complete.

(6) Bend around a form to the desired shape. This should be done

when the tube is at about "body" temperature (90-100 F.).

(7) Melt out the metal in boiling water. (The metal, of course, can be used over and over again.)

(8) Rinse out the tube in a solvent to remove oil film.

Having the tubing immersed in boiling water when pouring the metal is essential to prevent the metal solidifying before the tube is completely filled.

In closing, let me say that since I first became acquainted with your magazine about a year ago, it has given me many hours of pleasant reading and food for thought; not to mention the fact that my wife, who originally bought me a subscription as a Christmas gift, now has to be more persuasive than ever before to get me to do some things around the house, instead of tinkering around with my steam engines. In addition, your new format is a fine improvement, and my only objection is that the magazine is not bigger still.

Yours faithfully,

New Baltimore,
U.S.A. RALPH J. RASMUSSEN.

MOTOR CAR REPAIRS

DEAR SIR,—I was amazed and not a little amused at the article by "Duplex" (MODEL ENGINEER, January 29th, 1953) on repairing motor car components.

The carburettor in question is obviously an S.U. Concave manifold flanges on carburettors are common, but this trouble is not caused by too thick a gasket, but by over-tight fixing bolts.

Many such joints are made by gaskets over $\frac{1}{2}$ in. thick to insulate the carburettor body from the heat of the manifold.

Why on earth go to all the trouble of setting up the carburettor in the lathe, when the job could be easily done in about two minutes with a file? Since carburettor alloys are not noted for their strength, it could be done a good deal more safely too.

The statement by "Duplex" that S.U. pistons can grow and *keep on growing* may be correct. In something over 30 years in the motor trade, however, I have not known such a thing to happen. I am not, however, prepared to say it could not, and would be very interested to hear what the makers have to say about it.

The part of the article that goes before this does, however, take some swallowing. According to "Duplex" he was in the habit of pushing down a stuck piston with a pencil, and yet he tells us farther on that the diameter of the piston had to be *reduced by ten thousandths of an inch* before it would move freely. Some pencil—some push!

Before owners of such carburettors rush to remove large chunks off perfectly good pistons, they should, first of all, check on the following points, neglect of which can result in stuck pistons.

There should be no oil on the piston itself, only on the guide; thin oil only, too. If the suction chamber is removed, this should be replaced in its original position, and must go truly home. The needle must not be bent. The jet (into which the needle fits) must be central.

Unless the parts have been damaged beyond repair by inexperienced handlers, attention to these points should result in satisfaction.

Yours faithfully,

Salop. "INTERESTED."

HIGH PRESSURE HAZARDS

DEAR SIR,—Noting your remarks on this subject reminded me of an incident that occurred many years ago at Plymouth.

I was sent there from Bristol at the latter end of my apprenticeship to run a temporary shop dealing with scales and weighing machines. That was over 60 years ago.

A coal dealer asked me to call at his yard and examine a weighing machine. Whilst there, I noticed in a shed a very neat two-cylinder steam engine which he was using to drive a circular saw cutting up firewood. He said an engineer at the dockyard made it up for him and fitted him up. He then asked me to look at his boiler. When I saw it I was surprised that anyone calling himself an engineer should have put it in.

It was a light steel tank about 20 in. diameter and about 3 ft. long, as far as I can remember, laid along two rows of bricks built up for a furnace. Not a stay in the tank anywhere! I said, "You are taking a great risk using that as a boiler." He said, "It would take more than 40 lb. to burst that." I said, "You must remember that means 40 lb. per sq. in." Measuring across the end I told him the actual pressure that was trying to send the end out to meet him, and that as the pressure rose inside, the ends would "pant," which would eventually cause a pitting groove around near the edges of the ends and so weaken it more. I advised him not to steam up again until he got the ends stayed, or, better still, to scrap the thing and get a vertical central-flue boiler. He said, "You have made me afraid of it and I shall go to the engineering firm down the road and see if they can strengthen it or make me a new one; you are right about the ends springing out, as I can always tell when it is getting near 40 lb. pressure—I hear it come out with a plonk!"

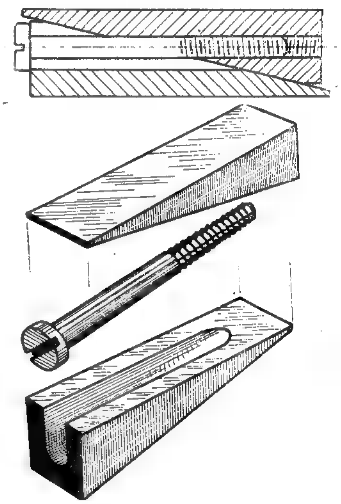
The next time I saw him he said a man from the engineering firm had been in; when he saw it he said it was a wonder he had not been killed. On no account should he steam it up again, and the best thing he could do was to scrap it and put in a vertical central-flue boiler. He gave them the order for the boiler, and decided to hand-saw the firewood until it was installed.

Yours faithfully,

Wallasey. A. E. NUTE.

AN ADJUSTABLE PACKING-PIECE

DEAR SIR,—Here is an illustration of an adjustable packing-piece which I have made for my own M.L.7 lathe.



To make it, a piece of square mild-steel is drilled from end to end 0 B.A. tapping size. It is then sawn in two diagonally, giving two pieces, as shown. The hole in one bit is tapped 0 B.A. and the hole in the other piece is opened out to 0 B.A. clearance.

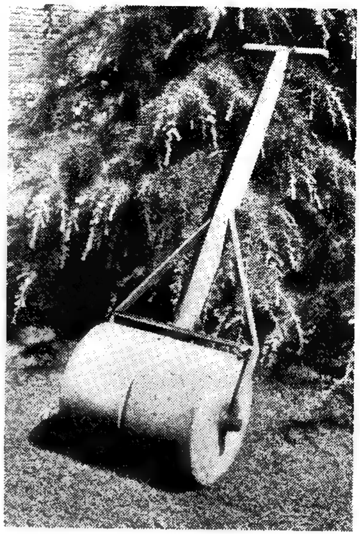
The piece with the clearance hole is then slotted as in the sketch, and both sloping pieces are filed smooth. If the device is assembled as shown, screwing up the 0-B.A. screw slides one wedge up the other, and enables the height of a tool placed on the top of the packing-piece to be set in about one-tenth of the time one spends in search of that most elusive of all necessities, a packing-piece of the right size.

Yours faithfully,

Maidstone. S. U. BELSEY

Making a garden roller

By H. G. Sharpe (Argentina)



THE back lawn was a carpet of weeds. Well, why not have the jobbing gardener dig it up and resow it with lawn grass. Then, when nicely rolled, putting practice would be in order. Rolled ? Where is the roller to be had ? None could be borrowed and rollers were expensive articles even in those days years ago. Why not make one ? It would not cost much and need not be elaborate, besides it would be interesting to make.

The idea grew and the roller came into being. An old oil drum sadly bashed in, provided a mould, as enough of it was in good condition and had a couple of peripheral corrugations which made the section rigid. This would give rolls of $15\frac{1}{4}$ in. diameter by $8\frac{3}{4}$ in. wide. A little calculation of weights showed that two of these would make a nice garden accessory. More hunting turned up a length of $1\frac{3}{8}$ in. diameter galvanised-iron pipe and the cardan shaft of a wrecked car. This latter would make the axle and two lengths from the piping would provide the casings, which would, of course, be bushed. For the frame $1\frac{1}{2}$ in. $\times$ $\frac{3}{8}$-in. iron strip could be purchased.

Preparing the Shaft

Both ends of a length of the shaft were turned down to receive the ends of the frame and threaded to take the nuts which lock the frame with the shaft. The remainder of the shaft was then given a light finishing cut. Two lengths of the piping were then end-faced and turned internally at each end to receive brass bushes.

The making of the rolls was now begun. The predetermined length was cut from the drum, taking care to see that the ends were dead square with the side. A wooden disc was cut to fit closely inside the drum and another thickness of wood nailed crossways to it to prevent warping. In the centre of the disc a hole was cut to receive an end of one of the casings, the other end being plugged with wood. Into this a nail was driven central with the casing and then beheaded. Three pieces of 2-in. $\times$ 2-in. wood were joined at their middles so that they looked like the spokes of a wheel. At their common centre a hole was bored to take the beheaded nail. Cleats were nailed to the spokes in such a way that the assembly was a tight fit on the drum.

A strip of lightweight galvanised-iron was cut to form a lining for the drum. An overlap allowed the ends of this lining to be soldered together while it was distended as tightly as possible inside the drum.

All being assembled, the mould was filled with concrete, a separately prepared rich mixture being used for the outside of the roll to a thickness of about one inch. A few days later it was an easy matter to slip the roll out of the drum, unsolder the G.I. lining, and repeat the operation.

The four flanged brass bushes were turned a driving fit in the casings. When assembling, the annular spaces between the axle and the casings were filled with melted lubricating grease.

When the frame and shaft had been made for me, I turned as long a handle as possible in my lathe. The handle is secured to the shaft by means of a strirup of $\frac{1}{4}$-in. steel rod passed through a hole in the shaft. One bend was made before and the other after insertion. As the shaft is made of a wood similar to teak, there was no difficulty in doing this.

The shaft is heavy and clumsy-looking, but was made so, as no counter-weight was provided, and a light shaft might easily break were the handle dropped.

The axle casings of the rolls project about $\frac{3}{8}$ in. on the outside faces and are flush on the inside faces. The flanges of the bushes and a steel washer give $\frac{3}{8}$ in. clearance between the rolls, the flanges also increase the clearance between the rolls and frame.

The crossbar above the rolls appears to be very heavy, that is because I made the mistake of putting a steel measure above these, thinking that the divisions would be visible in the photograph—they are not.

Before the rolls had become really hard I chamfered their edges with an old file.

The roller proved extremely useful, though perhaps not to me !

FOR THE BOOKSHELF

Greenly's Model Locomotive Designs and Specifications revised by E. A. Steel. (London : Cassell & Co. Ltd.) 62 pages, size 6 in. by 9 in. Illustrated by line drawings. Price 4s. 6d. net.

This is a much-revised edition of a handbook that the late Mr. Henry Greenly prepared and published in 1934. Some of the original designs for small-gauge model locomotives have been retained, but the selection of types for larger gauges has been revised with a view to bringing them more into line with modern practice.

The book comprises eight chapters, the first four of which deal with the fundamentals of design and details, while the other four present a fairly comprehensive selection of designs of model locomotives from $1\frac{1}{4}$ in. to 15 in. gauges. There is a specification and a sectional elevation for each one, so that the reader may form a clear idea as to which particular engine will best suit his purpose, not to mention his pocket and his workshop facilities. Most of the designs are based on well-known prototypes, though a few notable free-lance ones are included.

BRITISH CRAMPTON LOCOMOTIVES

By E. W. TWINING

PART I

This is the first of a series of articles, written by that doyen of model engineers Mr. E. W. Twining, and describing the various types of Crampton locomotives which were built for service on British railways about a hundred years ago.

Thomas Crampton was a man with original ideas regarding steam locomotive design and to our modern eyes, his engines would seem peculiar. Their history may be best described as "chequered"; they did not enjoy much popularity in Britain but they had a great vogue in France where some of them, reboilered and modernised, were in service, we believe, until about 1920. At least one of them, almost in its original condition, is preserved in France.

All the same, these engines seem to exercise some fascination over model engineers; from time to time, we have received enquiries from readers asking where drawings and particulars of Crampton engines could be obtained. This information does exist, but not in a form in which it is readily available to everybody; so when Mr. Twining mentioned to us that he possessed a great deal of information about these engines and could collect it together into a series of articles illustrated by his own drawings, we readily fell in with the idea. The result is that the articles were written and are to be published periodically, as space permits.

Readers will surely agree with us that the drawings of which the first examples appear here, are magnificent; in spite of his age, Mr. Twining has not lost that touch which has always made his drawings such a delight to study. Draughtsmanship of this quality is seldom, if ever, met with today; when we do meet it, we feel that it must have a rather subduing effect upon the minds of some of us who are inclined to fancy our prowess on the drawing-board!

The information contained in this series is historically valuable, interesting mechanically and useful to the model engineer who would try his skill on something unusual and not a little complicated.

Although these articles have been prepared primarily for model engineers, by a model engineer, they must surely appeal strongly to locomotive historians everywhere.

THE type of locomotive which these articles are intended to describe, to list and to illustrate, is that designed by Thomas Russell Crampton, who, in the year 1842, took out patents for an engine which should, and did, combine a large single driving wheel with a low centre of gravity; features which, at that time were deemed by railway engineers, essential to speed and stability.

Crampton undoubtedly realised the prevailing ideal conditions and he did this by placing the driving axle behind the firebox, above the footplate and drove it with cylinders fixed outside of the frames at points roughly midway between the driving axle and the front of the engine. By this arrangement there was left an almost unrestricted space for the low-pitched boiler barrel, which could be placed as far down as was consistent with the provision of ample heating surface and a deep firebox.

There were, in all, twenty-five locomotives of the type constructed in this country, of which five, on the South Eastern Railway, were the results of converting other engines to the Crampton wheel arrangement. These conversions all had smaller driving wheels than the genuine Cramptons and it is not proposed to include them with the engines built as originals under the patents.

So, it will be seen that there were twenty stern-wheel outside-cylinder engines, constructed as such, in this country; eighteen of them had 7 ft. diameter and two had 8 ft. diameter wheels. One of these latter was the famous and to some extent notorious *Liverpool*, which will be illustrated in due course.

A word or two regarding T. R. Crampton himself, may not be out of place here. He was born at Broadstairs in 1816, and began his career as an engineer under John

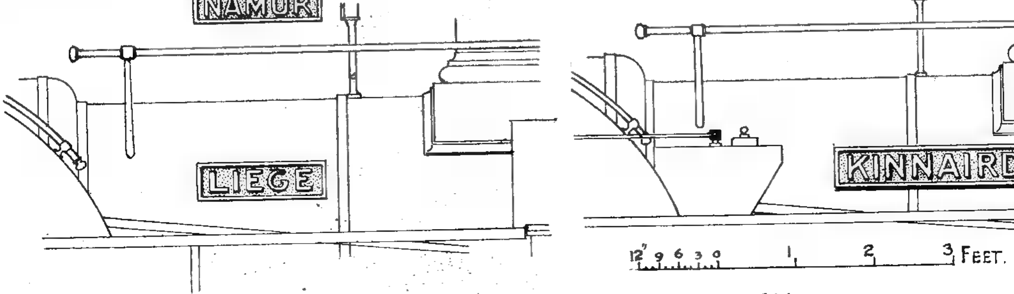


Fig. 3. *Nameplates on Works Nos.* 10, 11 *and* 14

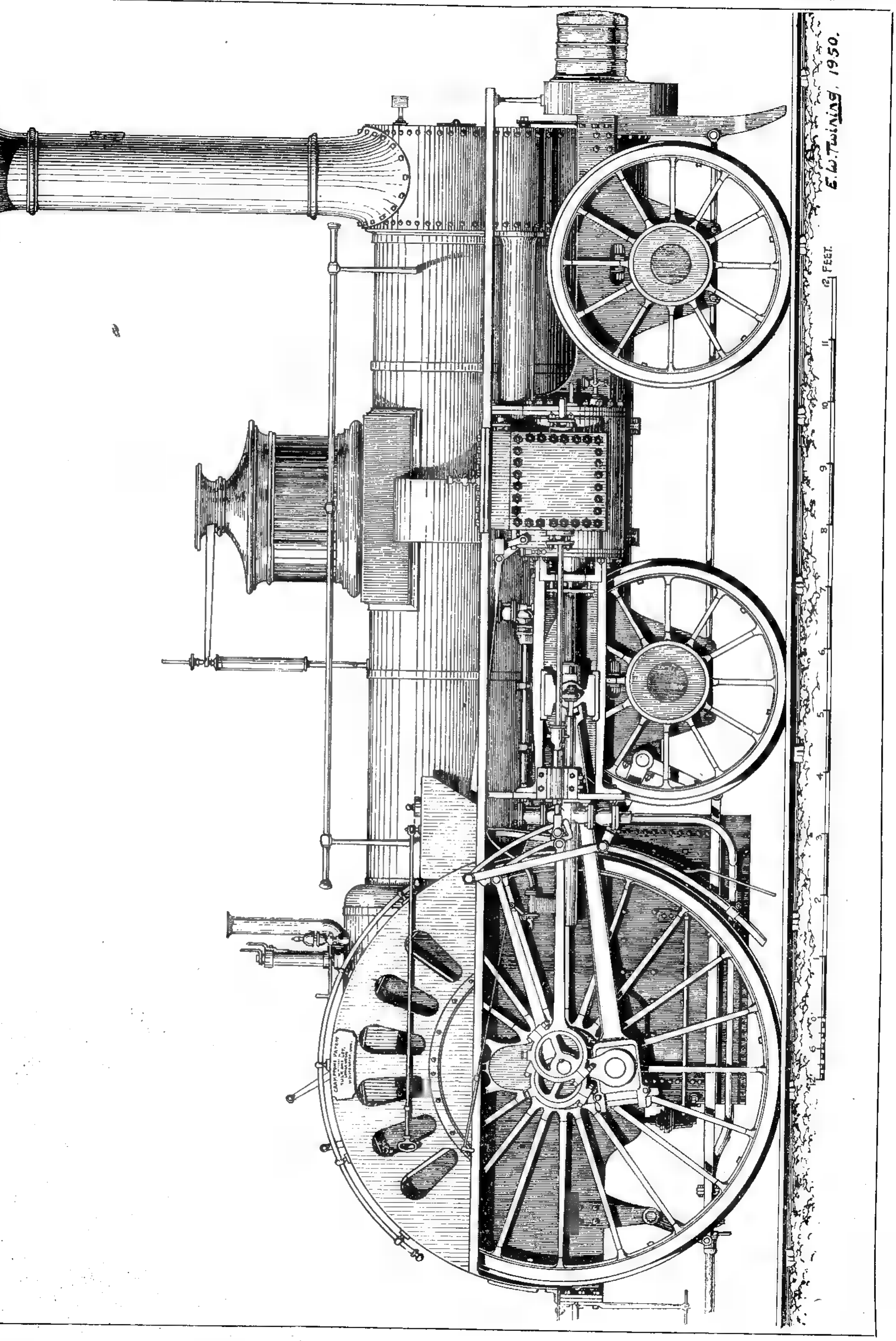
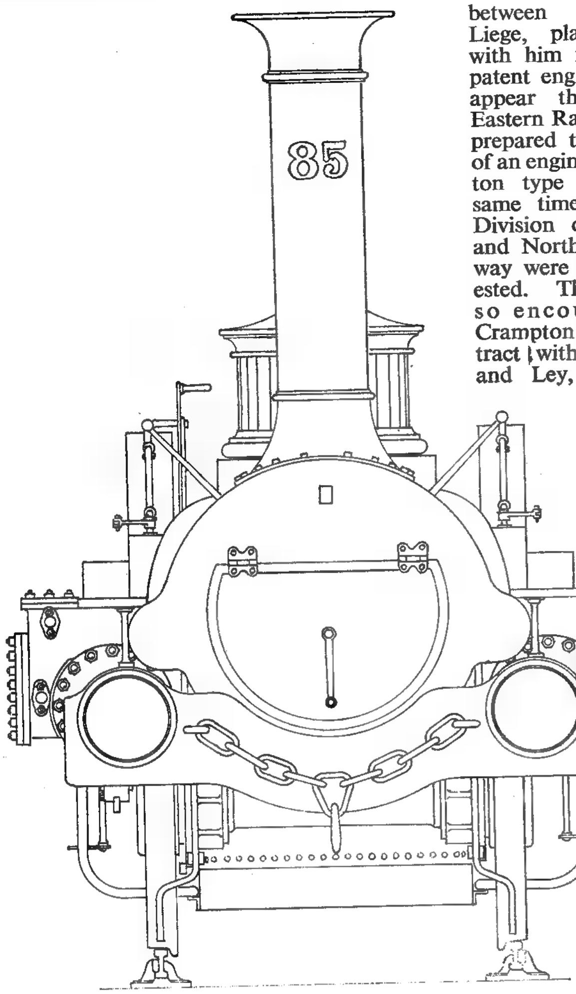


Fig. 1. The S.E.R., Tulk and Ley, Crampton engines Nos. 81, 83 and 85



Hague; later he was under Marc Brunel, the father of Isambard Kingdom Brunel, the engineer to the Great Western Railway. From this, it is not difficult to trace the influence which brought Crampton to Swindon where he assisted Daniel Gooch in the designs for the broad gauge 7 ft. singles of the "Firefly" class. But Crampton was not, at heart, a broad gauge man and he saw possibilities of designing narrow gauge locomotives which might be built as powerful and attain speeds as high as those prevailing on the Great Western broad gauge. The outside cylinder, stern-wheeler, was the result and at the age of 26 he took out his patents, although still remaining, until 1844, with Gooch.

By 1845 he had succeeded in arousing so much interest in his locomotive scheme that in July of that year the directors of a British company operating a Belgian railway between Namur and Liege, placed an order with him for two of his patent engines. It would appear that the South Eastern Railway were also prepared to make a trial of an engine of the Crampton type whilst, at the same time the Southern Division of the London and North Western Railway were definitely interested. The outlook was so encouraging that Crampton placed a contract with Messrs. Tulk and Ley, of the Lowka Engine Works, Whitehaven for six engines and, it has been said, doubtless with truth, that he ordered them in one lot. The first two were delivered to the Belgian Railway and were named *Namur* and *Liege* ; the third went to the South Eastern Railway and the rest were disposed of in accordance with the following table, which gives dates of delivery and the builders' works numbers.

It will be noticed that the works numbers run consecutively, but that number 12 is missing. The whole of the six engines in the list were alike when first constructed and, with the exception of a few added details, were as shown in the accompanying drawings: Figs. 1 and 2. But works number 12 was different; this engine had 8 ft. diameter drivers, larger cylinders and bigger heating surface; it was named *London*, ran on the North Western, Southern

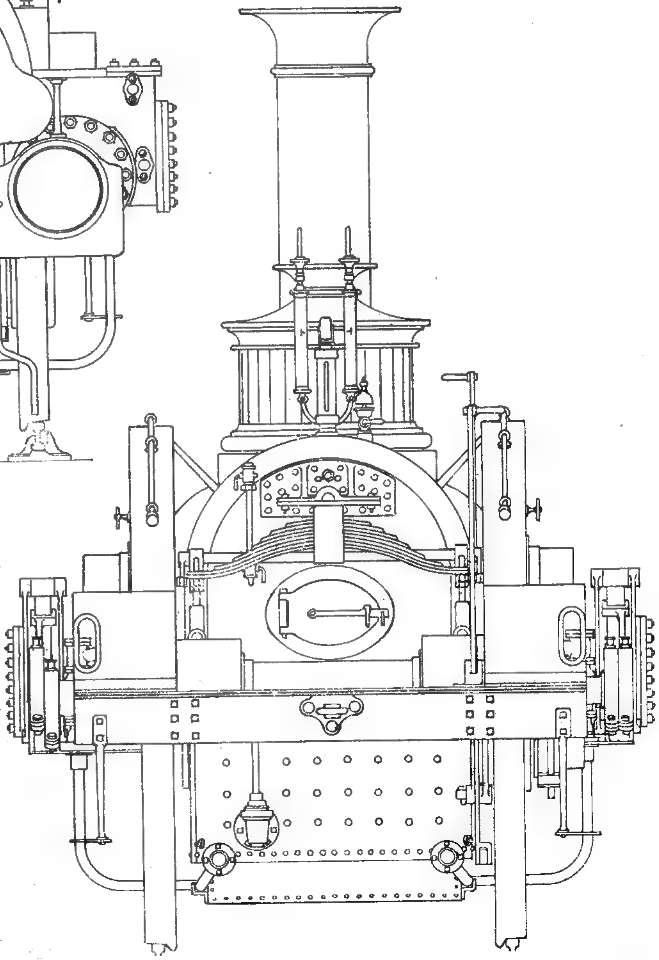


Fig. 2. Front and rear views of the Crampton engines, Nos, 81, 83 and 85

Date	Tulk & Ley Works No.	Engine Name or Number	Railway
1846	10	*Namur*	Namur and Liege Rly.
1846	11	*Liege*	„ „ „ „
1847	13	81	South Eastern Rly.
1847	14	*Kinnaird*	Dundee, Perth & Aberdeen Junction Rly.
1847	15	83	South Eastern Rly.
1847	16	85	„ „ „

Division and will form the subject of a following article.

There was a Crampton engine of the same dimensions as the six in the above list, bearing works No. 17. Little is known regarding this, but the probability is that it was built by Tulk and Ley on their own initiative, after the South Easterns, and not sold until 1854, when it went to the Maryport and Carlisle Railway. If this assumption is correct, it would be an inside-framed engine exactly like the others in the above list and, in any case, was the last Crampton constructed by the Whitehaven firm.

Referring again to the six 7 ft. engines; the added details mentioned above and shown in Fig. 1 are: the sandbox, pipe and sand-valve rod and the balance weights in the driving wheels. These have been copied from an old photograph, by the late R. E. Bleasdale, of the Dundee-Perth engine *Kinnaird*, Lowka works, No. 14. This old photograph, probably the earliest ever taken of a locomotive, shows *Kinnaird* with a spectacle plate or weatherboard, which, with the sandboxes, etc., were certainly later additions. Weatherboards, sandboxes and wheel balances were almost unknown in the years 1846 and 7. As the main purpose of these articles is to suggest suitable historic engines for model-making purposes these later items should be omitted if any engine, other than *Kinnaird* is chosen for a model.

In the end elevation, front view, one of the South Eastern Cramptons—works No. 16—has been selected in order to show the brass numerals attached to the chimney.

The principal dimensions of all six engines were as follow : Driving wheel diameter 7 ft.; carrying wheels, 3 ft. 9 in.; wheelbase, 6 ft. 9 in. plus 6 ft. 3 in. = 13 ft.; cylinders 16 in. bore by 20 in. stroke. Heating surface, tubes 927 sq. ft., firebox 62 sq. ft., total 989 sq. ft.; grate area 14.5 sq. ft.; working pressure 50 lb per sq. in.; weight 24 tons.

Fig. 3 shows the sizes and positions of nameplates. The three South Eastern engines were not named.

Other noteworthy features of the design of these engines were: inverted horns to the frames at the driving axleboxes, a single transverse spring anchored to a bracket on the back of the firebox, as shown in the rear elevation, Fig. 2, a firebox of peculiar form, very much longer at the firegrate than at the top and a boiler barrel composed of two segments of cylinders, so that its vertical diameter was greater than the horizontal, a row of internal cross stays being provided at the junction of the segments.

The making of a model of a Crampton engine should provide an extremely interesting occupation. With the exception of two engines, to be dealt with later, every part is so beautifully accessible, the valve-gear and valves especially so and, compared with models of modern engines and those of orthodox type, so simple to make, assemble and adjust.

It is proposed to give drawings of all the British-built Cramptons; there were seven different patterns, and they differed considerably in both size and appearance, and then possibly to make some practical suggestions for the modelling of them, with notes on the colours and styles of painting.

MAKING A DRAUGHTING MACHINE

(*Continued from page* 328)

Place the protractor and the set-square on the register on the head spindle with the assembly marks in position, and secure the parts together with 6 B.A. countersunk-head screws.

Finally, clamp the head spindle in the head plate with the finger knob and the machine is then ready for use.

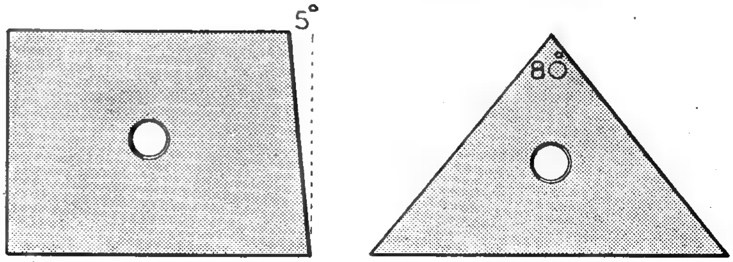
After aligning the set-square with the edge of the drawing paper, the index-line on the index plate is set to the zero-line of the protractor scale.

The machine as a whole will look better and will to some extent be protected against corrosion if the parts are specially finished. The arms can be painted with the kind of dull, black lacquer used in instrument work, and the joint-screws are blued by heating and dipping in oil. The appearance of the brass parts will be enhanced if they are lacquered to an old gold tint by either the hot or the cold process.

The wavy pattern found on instrument parts is sometimes known as snailing, and this finish can be put on brass work, before lacquering, by drawing the design free-hand with a slate pencil or a small emery stick.

When drawing screw threads, time may be saved by using the small, 5 deg. set-square shown in Fig. 17A. The square is turned over to reverse the direction of the thread slope, and the threads can be equally spaced by moving the small square with reference to the graduations on the fixed rule.

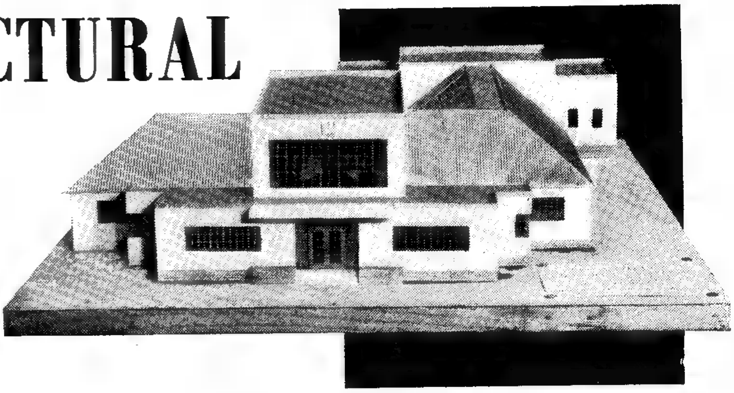
The small set-square shown in Fig. 17B is used for drawing the lines indicating a chamfer on the end of a shaft ; this saves having to reset the main set-square in two positions before again aligning it in its original position.



A B

Fig. 17. *" A "—set-square for drawing screw threads ; " B "—set-square for ruling chamfers*

AN ARCHITECTURAL MODEL



By W. J. Hughes

I AM lucky to live on a modern housing estate where there is a flourishing community association. This, in turn, is fortunate (and enterprising) enough to have a well-equipped and commodious community centre—though not commodious enough for all our various activities, the number of which has increased considerably since the association was first formed. In fact, had not the war intervened, the accommodation would have been approximately doubled years ago—but that is another story.

The Origin of the Model

Some time ago, I was approached by the secretary of the association, who informed me that there was to be an exhibition, to be held in Sheffield and to cover activities of members of all community associations in the area. Would I exhibit some of my models and other handicraft work, and would it be possible to build a scale model of our centre to show less fortunate communities what *could* be done by enterprise and foresight when building could be resumed?

The first request was easily answered in the affirmative; but as to the second, I was not too sure. As far as could be seen, my spare time would be fully occupied in the near future, but in a weak moment I said I'd see what I could do, especially since the architect's drawings were available and I should not have to do any measuring up of the actual building itself.

Making a Start

An evening was devoted to studying these drawings, and it was found that, despite a complete familiarity with the interior of the building, and the fact that I pass the exterior daily, it was possible to learn quite a lot from them. The drawings were to ⅛ in. scale, but it was decided to "double-up" on them and work to ¼ in. to 1 ft., which would give a baseboard size of approx. 30 in. by 30 in. The ground slopes upwards towards the rear of the premises, but the baseboard would be flat, and the slope built up afterwards with Pyruma cement.

Eventually, a start on the model itself was made about 16 days before the exhibition was due to open; and, because of the shortage of time, no attempt was made at "finish" of interior parts which would be hidden on completion of the model—a decision to be deplored by all right-thinking modellers, but the only one possible in the circumstances.

The Baseboard

The baseboard was a piece of very poor quality plywood from the back of an old picture, fixed on top of a strengthening frame of 1½ in. × 1⅛ in. Oregon pine cut from old shelter-bunks. The framework was "jointed" with 2½-in. oval nails and glue, and the ply glued and nailed down to it. The position of the walls having been set out, holes were cut in the base which would allow the doors and windows to be placed in position after the building was erected, working from underneath, inside.

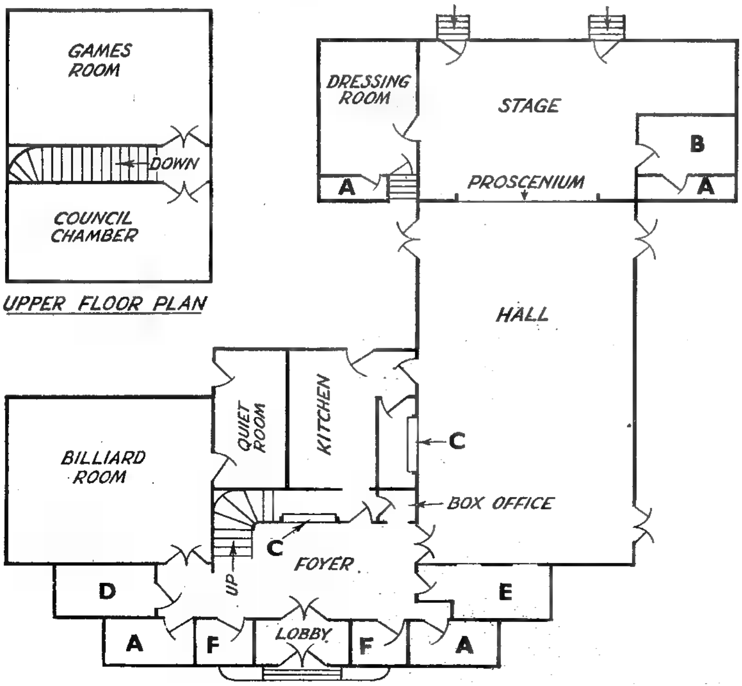


Fig. 1. Plan of ground floor and upper floor

A—*Lavatories.* B—*Dressing Room.* C—*Buffet Counters.* D—*Secretary's Office.* E—*Cloak Room.* F—*Store Rooms.*

Starting the Building

The first part of the building to be made was the rectangular two-storey block. The roof was a piece of $\frac{5}{8}$ in. thick deal, planed to breadth and thickness, a slight apex being left in the middle to match that of the prototype. The sides of $\frac{1}{16}$-in. ply were then cut to size, and the door and window openings marked out with marking-gauge and try-square.

The method of cutting door and window openings throughout the building was to lay the ply on a piece of waste wood, and to chop about $\frac{1}{16}$ in. inside the line, using a mallet and *very keen* chisel, afterwards cutting back to the line. This was considerably quicker than fret-sawing them out.

The sides were now pinned and glued to the roof, and to lengths of $\frac{3}{8}$-in. square section stripwood, fitted in each vertical corner and along the bottom of each side. This resulted in quite a strong structure.

The next part was the stage-cum-dressing-room structure at the rear, which was built on similar lines. These two buildings having been screwed to the baseboard, vee-shaped pieces $\frac{5}{8}$ in. thick were glued and pinned to them to support the sloping roofs of the remaining structure, and additional roof supports were also prepared and fixed down. (See Fig. 2.) All these pieces were cut from a box purchased at the grocer's.

It was then a simple but somewhat tedious matter to set out, cut to shape, and fix in position the remaining walls, which also were reinforced at top and bottom edges and in the corners with $\frac{3}{8}$-in. square stripwood.

At this stage of the proceedings, I was informed by the secretary that, owing to unforeseen circumstances, the exhibition had had to be brought forward, and now would open in a week's time. Thus it looked as if I should have to work quickly, but here Fate had a trump card up her sleeve, of which more anon.

I began to work feverishly in covering the walls with "OO"-gauge (4-mm. scale) building paper in yellow brick. The bricks on the paper were only 5/32 in. long instead of the $\frac{3}{16}$ in. they should have been, but no other was available, and no one has noticed the difference so far.

The method was to cut a piece of paper to cover one wall, paste it on the back, and stick it on, smoothing down with a rag. Where door and window openings occurred, the point of a pen-knife blade was plunged through the middle of the opening, and diagonal cuts made up to each corner (see Fig. 3A). The four flaps were bent inwards and stuck down inside.

After covering the walls, the whole interior of the building was stained with ebony aniline spirit-stain, to prevent bare wood being seen through the windows to give a false impression.

The Roof

This was made from corrugated aluminium sheet. The corrugations were at $\frac{1}{8}$ in. intervals, representing 6 in. on the prototype—just about right for the ridges in the tiles with which it was laid. Having cut the pieces to shape, they were pinned in place. Strips of self-adhesive cellulose parcel tape were cut and stuck over the ridges and corners of the roof to represent the ridge-tiles.

This having taken less time than had been anticipated, a start was made on the grey brickwork at the base and head of the walls. I had not been able to buy grey brick paper, but bought some grey which was laid out in black rectangles to represent slate roofs for doll's houses. This was pinned to the drawing-board, and with tee-square, drawing-pen and white ink, was marked out with parallel lines the correct distance apart. No vertical lines were drawn, but the finished effect on the building was not bad. The paper was cut into strips and pasted on, though not everywhere, because I wanted to get some of the doors and windows in.

The windows were of varying heights and breadths, so that standardisation was not possible. Even the widths of the *panes* were different —the windows in the front of the building, 3 in. long, had seven thick vertical sash-bars and six thin ones, while the narrowest windows were $\frac{1}{2}$ in. wide, with two thick uprights and one thin one. Thus the panes in the latter are narrower than in the former—and the window widths were in every multiple of $\frac{1}{2}$ in. up to 4 in. Similarly, though all the windows save the one under the clock were, so to speak, three panes tall, some were 1 in. high, some $\frac{7}{8}$ in., and a few $\frac{3}{4}$ in.

The large front upper window was tackled first, and lines to represent the sash-bars were scribed on a piece of $\frac{1}{16}$-in. Perspex, the wide ones being made with a dental scraper (war surplus). This was hooked, with a chisel-shaped edge about $\frac{1}{16}$ in. wide. After marking the "frames," some green paint was rubbed in the incisions with a cloth, and polished off with a clean cloth, leaving the marks outlined in green. The Perspex was then cut to leave a $\frac{1}{4}$-in. margin all round and placed in position with the marks on the inside. It was secured with strips of self-adhesive cellulose tape over its margins. However, owing to hurried work in calculating and setting-out, the spacing was not

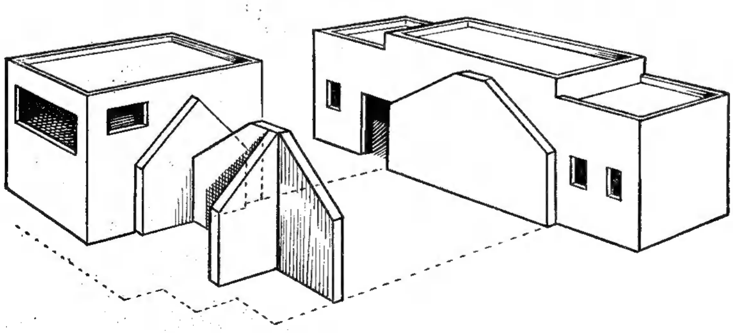


Fig. 2. View showing roof supports for hail.

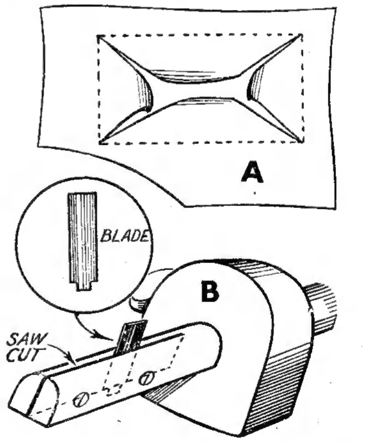


Fig. 3. A—*Method of cutting building paper for window openings.* B—*Special blade fitted to marking-gauge for marking window sash-bars*

even, and it was realised that an improved method was desirable.

This involved setting-out carefully the different sizes of window on a piece of paper, using tee-square and set-square. Then the stem of a marking-gauge was slit at the opposite end to the spur, and a small bit of hacksaw blade clamped in with wood screws (see Fig. 3B). A strip of Perspex having been cut about $1\frac{1}{2}$ in. wide and 12 in. long, it was fastened (with drawing-pins) parallel with the bench-edge, and lines were gauged to represent the horizontal sash-bars, the ordinary pointed spur scoring the fine lines and the " blade " those at top and bottom. The lines went full length of the material, of course, giving sufficient to make several windows all of the same height.

Then the set-out paper was pinned parallel with the bench-edge, and the Perspex pinned over it. With the aid of a try-square, the vertical lines were scribed next, using a pointed scriber for the narrow sash-bars and the dental scraper for the wide ones.

Individual windows were sawn off, rubbed with paint, polished off, and fastened in with the cellulose tape over the margins, as before.

The main entrance doors are surrounded by glass bricks to give extra light to the foyer. The Perspex having been scribed for these, and for the sash-bars of the doors, the " bricks " were rubbed lightly inside with fine glass-paper—they are translucent rather than transparent—and the " sash-bars " received the paint treatment. The " doors " themselves were set out in indian ink on green paper, cut out, and stuck on *outside* the Perspex, which was then fixed in position.

The clock was set out on paper in indian ink, and cemented in place behind a square of Perspex.

At this stage, the model was collected for the exhibition, and the photographs, which were taken there (and which embellish this article), show that though unfinished, it didn't look too bad, though I was sorry I had not had time to paint the roof.

Finishing

On return from the exhibition, the remaining " grey brick " was pasted on and the rest of the windows fixed in. The large front upper window was replaced with one correctly set out, and the edge of the clock Perspex was painted black to represent the case.

The " tiled " roofs were painted green, very lightly mottled in red with a small bit of fine rubber sponge, and look extremely realistic.

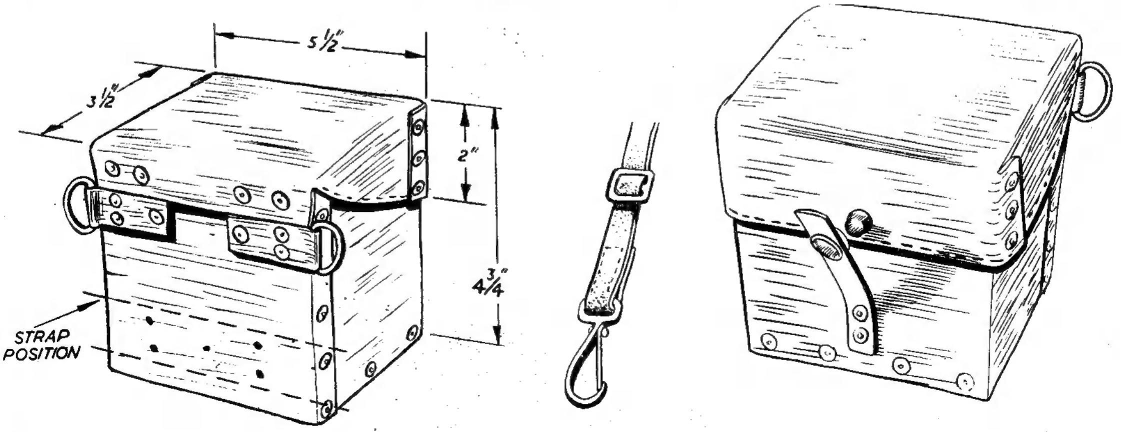
The " sloping ground " having been built up with Pyruma, it was laid out in grey and brown paint to represent, respectively, the asphalt paths and the flower beds. The " asphalt roofs " also received another coat of grey. Finally, the rough edges of the base were covered with a $1\frac{1}{4}$-in. half-round beading, neatly mitred at the corners, and painted green.

FROM POUCH TO CAMERA CASE

IN the 1952 " Model Engineer " Exhibition number, Messrs. Batley & Co. Gorsey Works, Stockport, advertised leather " pouches " $5\frac{1}{2}$ in. $\times$ $3\frac{1}{2}$ in. $\times$ 9 in. deep at 3s. 6d. each. I obtained one of these in order to convert it into a camera case which would also take my exposure meter, spare films, filters and so on, which the usual cases do not. I did this, and here are the details.

My camera is a Zeiss Ikonta $2\frac{1}{4}$ in. square and it just drops exactly into the $5\frac{3}{8}$ in. inside width. Other makes will need measuring to see if they will go in. The cases are of yellow hide on fibre board with riveted joints and I am told they were made for Home Guard ammunition cases. The strap was 4 in. to 6 in. long, but it is too heavy for camera needs. Seventeen rivets must be taken out; the ends can be snipped round with side-cutting pliers, and then the washers prized up. This detaches the strap, lid, lid fastener and the back tab. The top of the box is now cut off with razor for the leather, and a saw for the fibre. The bottom is made $4\frac{3}{4}$ in. deep, which is plenty, and avoids the central rivets. The new top edge can be stitched by a saddler, and later the lid refixed. The supports must go on the back, and the straps for the D's are cut from the back tab, and must be thinned down. Grease or wet them before bending in half, or the leather will crack. Khaki webbing $\frac{3}{4}$ in. wide, finished with a D loop and spring hook, used to be on sale in " surplus " shops. I find 39 in. is my length, so their 48 in. allows for turn-up and adjustment. New copper rivets and washers No. 12-g. $\times$ $\frac{5}{16}$ in. are obtainable; 1 oz. will provide about 28 pairs. A $\frac{1}{16}$ in. punch for the rivet holes and a bit of round brass rod whose end is drilled with a clearance hole for the rivet will be needed to drive down the washers on to the leather and make all firm. The spring-button fastener was too stiff for a camera, so I scrapped it and employed an old snap cuff-link, as I have never found suitable spring-fasteners in the shops. The sketches will make all plain.—

H. E. ADSHEAD.



QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

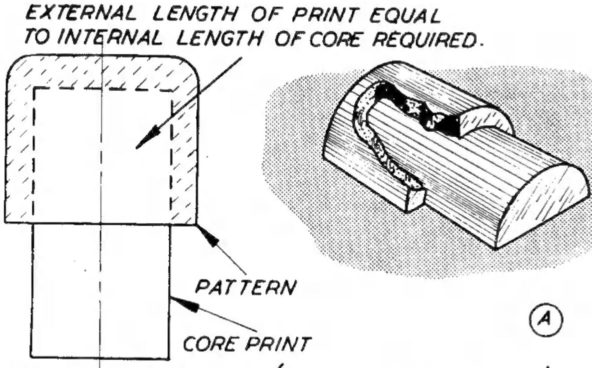
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Pattern Making

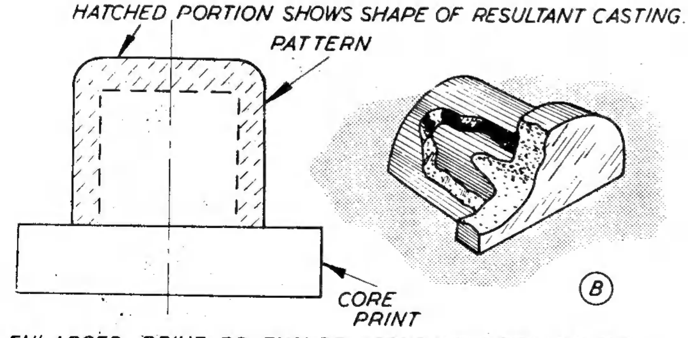
I wish to make a pattern for a cylindrical object with a closed end, and I am informed that this will have to be cored. My informant tells me that it is not necessary to make a special core box for a plain circular and parallel core, and all that is necessary is to leave a core print of the required diameter on the pattern. Is this correct, and also how long should the core print be?

A.H. (Croydon).

The general rule for castings in which a blind core is required is to leave a print on the pattern of the same diameter as the required core and projecting as far outside as the depth of core required inside, as at *A*. This procedure is only permissible however, when the truth of the core and its concentricity with the outside of the castings are not very important. Where accuracy of the core is essential, the print should be of larger diameter than the required core, up to twice the size or more, as at *B*, and a core box having a stepped bore to suit the size of core and print respectively will then be required.



PLAIN CYLINDER CORE (NO COREBOX REQUIRED)



ENLARGED PRINT TO ENSURE ACCURATE CORE LOCATION
(SPECIAL COREBOX REQUIRED)

Graphite in Ball-bearings

I am proposing to use graphite grease for the lubrication of a reduction gearbox, as it appears to be the best form of lubrication for gear teeth, but this gearbox has ball-bearings, and I am informed that graphite grease should on no account be used for such bearings. Will you please advise me whether the graphite is likely to have a detrimental effect?

J.W. (Sheffield).

Ordinary graphite is of a comparatively coarse texture, and tends to interfere with working clearances and proper rolling action in ball or roller-bearings, also in some cases it is not above suspicion in respect of chemical purity.

The modern form of colloidal graphite is, however, much more finely divided, and entirely acid-free, and is stated to have no detrimental effects on each bearings. In view of the extreme hardness of their surfaces, however, and the high finish, which leaves no interstices for the graphite particles to penetrate, the particular advantages of this form of lubrication cannot be fully realised. In theory, lubrication of ball or roller-bearings in the true sense is impossible, and generally speaking, any lubricant introduced into such bearings serves the practical purpose of reducing noise, and protecting the surfaces from corrosion, rather than lubricating them.

Air Compressor

I have a twin-cylinder air compressor of 2 in. bore by 2 in. stroke, fitted with a 12 in. diameter driving pulley. I wish to use this for paint spraying and also to supply air, for a gas-air torch.

Can you inform me of the cubic capacity of this compressor, and the size of air tank it would need for the work specified, also the size of electric motor needed to drive it? Are there any specified air pressures for paint spraying and a gas-air torch?

C.P. (Barnsley).

The displacement of this compressor will be 6.283 cu. in. for each cylinder, making a total of 12.566 cu. in. At a speed of five to six hundred r.p.m. this should be adequate for paint spraying purposes, and the power required would be approximately $\frac{3}{4}$ h.p. at full capacity, producing a pressure of approximately 50 lb. per sq. in.

The size of air tank necessary for a compressor of this type should be about 1 to $1\frac{1}{2}$ cu. ft. capacity, although it would work with a smaller air tank, as the output from

a twin compressor is fairly continuous. A large air tank, however, does help to avoid rapid fluctuations of pressure in cases where the work is intermittent.

Pressures for paint spraying vary according to the consistency of the paint. Thin cellulose can be sprayed at pressures of 10 lb. or even less, but thicker and heavier paints may require much higher pressure. Only a very small pressure, not more than three or four pound per square inch, is employed for a gas-air torch, and generally speaking, it is more efficient to use a rotary type of blower than the reciprocating compressor for this work.

Model Locomotive Boiler

It is proposed to build a 1½-in. scale locomotive boiler from 16-*gauge copper, or* 13-*gauge. Do you consider if the boiler is close riveted with* 3/32-*in. rivets, all joints and rivets tinned and the whole riveted up afterwards, it will make a sound job to stand say* 60-100 *lb. per square inch, or do you consider it better to silver-solder and rivet? I would value your opinion.* W.F.B. (Dorchester).

We would say that 16-gauge copper is absolutely useless for a 1½-in. scale locomotive boiler. The copper should be *at least* ⅛-in. thick and the boiler should be built strongly in the all-rivet manner. You could never make a boiler of this size by silver-solder and riveting.

Steel Water-Tube Boiler

I intend building a water-tube boiler for a compound high-speed engine, at not less than 150 *lb. per sq in. Could I use* ½ *in. gas barrel for the tubes,* 12 *in. long; top drum of* 4-*in. steam tube* (*iron*), *with ends screwed on? I am unable to make headers and connect same to drum, as I have no forge. Could I use iron casting, and expand tubes into them?* B.S. (Leigh).

We do not recommend ordinary gas barrel for the boiler tubes, as it would prove unreliable. It would be better to use best "steam" tube. For the steam drum we would advise 5 in. tube, if possible, the ends being cast mild-steel, riveted on after the tubes have been screwed in and back-nutted. There is no need to fit downcomer tubes. We would also suggest cast mild-steel mud-drums, semi-circular in shape, with dished cover-plates, which can be screwed or bolted on after the water-tubes have been expanded in. It is impossible to make a good, serviceable boiler cheaply, and good material will repay itself, as well as reduce personal risks.

WITH THE CLUBS

The Society of Model and Experimental Engineers

There will be an informal meeting at Caxton Hall on Saturday, March 14th, at 2.30 p.m. To ensure plenty of material for discussion, will members please bring along samples of their work, successful or otherwise. Visitors will be welcome.

Full particulars of the society may be obtained from the secretary: E. C. YALDEN, M.C., 31, Longdon Wood, Keston, Kent.

Sussex Miniature Locomotive Society

Members are now meeting every other week-end to carry out works on the site at "Beechhurst." To date, the bricks have been placed in position for the piers. All the setting-out is completed, and the levelling will be completed, perhaps by the time this note is in print.

From the piers, the rising gradient will be in the neighbourhood of 1 in 122½, and the down straight about 1 in 60, so visitors had better be overhauling their brakes!

Hon. Secretary: S. R. BOSTEL, 8, Cranbourne Street, Brighton, 1.

Reading Society of Model and Experimental Engineers

The above society held their annual dinner and social recently. The chair was taken by Mr. J. N. Maskelyne, the president of the society, and despite the influenza epidemic, there was a good attendance of members and their friends.

At a previous meeting, Mr. Lakey gave some interesting notes on steel-hulled river craft.

Good work is progressing on the arrangements for the forthcoming exhibition to be held at Palmer Hall, April 27th to 30th.

Hon. Secretary: J. SHAYLER, 14, Westwood Road, Tilehurst, Reading.

The Brighouse Society of Model and Experimental Engineers

The annual general meeting of the above society was held recently at the headquarters, "Ravensprings Park," when the financial account for the past year was discussed and passed as satisfactory.

Officers were duly elected to serve for the coming season.

The President's Cup, awarded annually for the best effort during the year, was presented to Mr. A. G. Bottomley, of Halifax, for his work on a model of the Dutch tug *Zwarte Zee*.

It was decided that all members on reaching the age of 65 will be considered for honarary membership; we do not anticipate a big increase in the older members, but think that such fidelity should be rewarded.

We are looking forward to the coming season with anticipation, several new models being on the stocks—we are waiting to see them perform. We shall be pleased to welcome new members and feel sure our facilities will help any contemplating member.

Membership forms can be obtained from the secretary MR. W. DIXON, 293, Bradford Road, Brighouse.

The Junior Institution of Engineers

Friday, March 13th, at 7.0 p.m., Townsend House, Greycoat Place, S.W.1. Informal meeting. Paper: "Electronic Components—The Elements of an Industry," by J. D. Hinchcliff, B.Sc. (Eng.), A.M.I.E.E. (member).

Friday, March 20th, at 7.0 p.m. Townsend House, Greycoat Place, S.W.1. Ordinary meeting. Paper: "The Aether—An Engineering Conception," by J. Heywood (associate member and Durham Bursar).

Friday, March 27th, at 7.0 p.m. Townsend House, Greycoat Place, S.W.1. Informal meeting. Paper: "Copying Lathes," by K. J. Downes (associate member).

Midland Section. Wednesday, April 1st at 7.0 p.m., at the James Watt Memorial Institute, Gt. Charles Street, Birmingham. Discussion evening. "Pressworking Machines, Methods and Problems."

Friday, April 10th, at 7.0 p.m. Townsend House, Greycoat Place, S.W.1. Ordinary meeting. Paper, "Developments in the Design of the Steam Locomotive," by D. M. Hunter (associate member and Durham Bursar).

Sheffield and District Section. Monday, April 13th, at 7.30 p.m. Livesey Clegg House (opposite Union Street Cinema), Sheffield. Film evening.

Friday, April 17th, at 7.0 p.m. Townsend House, Greycoat Place, S.W.1. Informal meeting. Paper: "Graphic Reproduction," by J. F. Trusty (member).